ENVIRONMENTAL AND SOCIAL IMPACT ASESSMENT (ESIA)

UPPER CISOKAN PUMPED STORAGE (UCPS) HYDROPOWER PROJECT 1040 MW

PLN

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ABBREVIATIONS

ACSR = Aluminium Conductor Steel Reinforced
ANDAL = *Analisis Dampak Lingkungan Hidup*/ Environmental Impact Analysis Report
AMDAL = *Analisis Mengenai Dampak Lingkungan Hidup*/ Environmental Impact Analysis
ANFO = Ammonium Nitrate Fuel Oil
AoI = Area of Interest
AWLR = Automatic Water Level Recorder
BIA = Biodiversity Important Area
BKSDA = *Badan Konservasi Sumber Daya Alam*/Nature Conservation Agency
BMP = Biodiversity Management Plan
BOD = Biological Oxygen Demand
BPD = *Badan Permusyawaratan Desa/*Village Representative Council
CITES = Convention on International Trade in Endangered Species
CO = Carbon Monoxide
COD = Chemical Oxygen Demand
CR = Critically Endangered IUCN Category
DAS = *Daerah Aliran Sungai*/Watershed
DI = *Daerah Irigasi*/Irrigation Area
DO = Dissolved Oxygen
DPT = *Dinding Penahan Tanah*/Retaining Wall/Rock
EIA = Environmental Impact Assessment
EMF = Electromotive Field
ESDM = *Energi Sumber Daya Mineral (Minerba)*/Indonesian Ministry of Energy and Mineral Resources
ESIA = Environmental and Social Impact Assessment
ESF = Environmental and Social Framework
EN = Endangered IUCN Category
ESMP = Environmental and Social Management Plan
ESS = Environmental and Social Standards
ESCP = Environmental and Social Commitment Plan
FDC = Flow Duration Curve
FTIP = *Fakultas Teknologi Industri Pertanian*/Faculty of Agroindustrial Technology
GBV = Gender Based Violence
GEV = Generalized Extreme Value
GPS = Global Positioning System
GSW = Galvanished Steel Wire
GTF = Grievance Task Force
GW = Giga Watt
Ha = Hectare
HC = Hydrocarbon
HSE = Health, Safety, and Environment
HWL = High Water Level

Hz	= Hertz
IMA	= Independent Monitoring Agency
IUCN	= International Union for Conservation of Nature
km	= Kilometers
km^2	= Kilometer square
kp.	= *Kampung*/hamlet
kV	= Kilo Volt
LARAP	= Land Acquisition and Resettlement Action Plan
LKMD	= *Lembaga Ketahanan Masyarakat Desa*/Village Community Resilience Council
LMP	= Labor Management Procedures
LPM	= *Lembaga Pemberdayaan Masyarakat*/Community Empowerment Council
LWL	= Low Water Level
m	= meters
m^3	= Cubic meters
mm	= milimeters
MCK	= *Mandi Cuci Kakus*/bathing, washing as well as serving as a lavatory by the community
MW	= Mega Watt
NA	= Not Available
NAB	= *Nilai Ambang Batas*/Threshold Value
NO_2	= Nitrogen Dioxide
OPGW	= Optical Ground Wire
PAPs	= Project Affected Persons
P2T	= *Panitia Pengadaan Tanah/ Land Acquisition Committee*
P3A	= *Petani Pengguna Air*/Water User Farmer
PAUD	= *Pendidikan Anak Usia Dini*/Early childhood education
PCR	= Physical Cultural Resources
Permen	= *Peraturan Menteri*/ ministerial decree
PKK	= *Pembedayaan Kesejahteraan Keluarga*/Family Empowerment Council
PLN	= *Pembangkit Listrik Negara*/State Electricity Company
PPKH	= *Pinjam Pakai Kawasan Hutan*/forest lease-to-use
RCC	= Roller Compacted Concrete
RKL	= *Rencana Pengelolaan Lingkungan Hidup* Environmental Management Plan
RPL	= *Rencana Pemantauan Lingkungan Hidup* Environmental Monitoring Plan
RUPTL	= *Rencana Usaha Penyediaan Tenaga Listrik* / Electricity Supply Business Plan
Sec	= Second
SAA	= Social Acceptance Assessment
SCMP	= Social Community Management Plan
SNI	= *Standar Nasional Indonesia*/Indonesian National Standard
SO_2	= Sulfur Dioxide
SOP	= Standard Operating Procedure
SPPT	= *Surat Pemberitahuan Pajak Terutang/* Land and Building Tax
SUTET	= *Saluran Udara Tegangan Ekstra Tinggi*/Extra High Voltage Transmission Line

TDS	= Total Dissolve Solids
TMKH	= *Tukar Menukar Kawasan Hutan*/Forest Estate Exchange
TSP	= Total Suspended Particulate
TSS	= Total Suspended Solid
UCPS	= Upper Cisokan Pumped Storage
UKL	= *Upaya Pengelolaan Lingkungan Hidup/Environmental Management Effort*
Unpad	= Universitas Padjadjaran
UIP	= *Unit Induk Pembangunan* (development business unit)
UPL	= *Upaya Pemantauan Lingkungan Hidup/ Environmental Monitoring Effort*
USLE	= Universal Soil Loss Equation
VU	= Vulnerable IUCN Category
WTP	= *Warga Terdampak Proyek*/Project-affected People

EXECUTIVE SUMMARY

EXEC 1. INTRODUCTION

The ESIA presents an assessment of potential environmental and social risks and impacts of the Upper Cisokan Pumped Storage (UCPS) hydropower project. This ESIA document is an update of the EIA prepared and submitted to the World Bank in 2011. This update was carried out to comply and align with the environmental and social standards (ESS1 – ESS10) of the World Bank Environmental and Social Framework 2018. There are three associated plans namely the ESMP (Environmental and Social Management Plan), SCMP (Social Community Management Plan), and BMP (Biodiversity Management Plan) and two frameworks i.e. LARF (Land Acquisition and Resettlement Framework) and Forest Partnership Framework (FPF). These plans and frameworks detail the mitigation measures that must be carried out in order to minimize the potential negative environmental and social impacts that may arise as a result of the UCPS hydropower project construction, inundation and operational activities.

The UCPS Scheme is a peak power generation plant that will provide up to 1040MW of electricity to the Java-Bali grid, on the island of Java, Indonesia. The developer is the State-Owned Enterprise Perusahaan Listrik Negara (PLN). The UCPS is located on the boundary of two regencies, West Bandung and Cianjur, within the Cisokan River catchment (a sub-catchment of the Ciratum River). This is the first pumped storage scheme in Indonesia. Pumped storage is very different than conventional hydropower. Electricity is generated during peak daily periods as water is released from the upper reservoir through tunnels to the powerhouse and discharged to the lower reservoir. During off-peak periods water is pumped from the lower reservoir back up to the upper reservoir, consuming energy from the grid in the process. Water is recycled between reservoirs on a daily basis and all other river inflow is passed downstream through the dam structures.

PLN has approached the World Bank to finance the construction of the UCPS scheme. The Concept Project Information Document for the 'Development of Pumped Storage Hydropower in Java Bali System Project (P172256)' was approved in January 2020. This is a renewed engagement between the World Bank and PLN on the UCPS, which started in 2008 with the Upper Cisokan Pumped Storage Hydro-Electrical (1040MW) Power Project (P112158).

In May 2011, the World Bank approved a US$640 million IBRD loan to support the development of the Upper Cisokan Pumped Storage (UCPS) Project as well as the feasibility study and Environmental and Social Impact Assessment (ESIA) for the Matenggeng Pumped Storage (MPS) Project. Unfortunately, the project faced several delays. The early implementation periods needed to focus on land acquisition, resettlement and finalizing the mapping of biodiversity important areas and finding sustainable ways to deal with these issues. This took longer than foreseen during project appraisal and was only completed after four years. Furthermore, it took almost two years before an owner's engineer was hired and the technical design process for the plant could start. Due to inadequate quality of work by the owner's engineer, the design of the plant also needed to be revised following the guidance of the Project Review Panel (PRP). By early 2016, all the main issues had been largely completed and procurement of the three main contracts successfully carried out – ending with contract signing for the construction of the civil works and hydraulic metal works; and award of contract for the electro-mechanical works. However, the access road which was originally to be provided by PLN to the contractor was not completed at the time, and subsequently a major landslide further deteriorated parts of the already incomplete access road. Due to the inability of PLN and the contractor to agree on the contractual terms under this scenario, start of construction of the main civil works contract (Upper and Lower Dams, Powerhouse and Underground Works) was severely delayed. While the Bank proactively encouraged for an early resolution of the resulting contractual differences between PLN and the contractor, those turned out to be intractable. As of May 2, 2017, only US$32.9 million (5 percent) of the project funding was disbursed, and due to the lack of progress on resolving the dispute, the Bank decided to partially cancel US$596 million of the loan associated with the construction of the physical facilities of UCPS Scheme. The revised UCPS Project has since then been restructured to focus on the feasibility study and ESIA for the Matenggeng Pumped Storage Project (Another Pumped Storage Scheme that PLN envisaged to construct after UCPS), as well as capacity building.

Therefore, the UCPS environmental and social assessment has been informed by a broad range of studies, stakeholder engagement and reports undertaken by PLN between 1998 and 2020. The set of documentation prepared for the World Bank funding appraisal for the proposed *Development of Pumped Storage Hydropower in Java Bali System Project* (P172256) are an update and synthesis of this extended program of work and engagement with the World Bank. The updates have been prepared to reflect the current state of the project and to comply with the environmental and social standards of the World Bank Environmental and Social Framework. The documents disclosed now for public consultation and feedback are:

- Environmental and Social Impact Assessment. Upper Cisokan Pumped Storage (UCPS) Hydropower Project 1040MW. Draft. February 2021.
- Environmental and Social Management Plan. Upper Cisokan Pumped Storage (UCPS) Hydropower Project 1040MW. Draft. February 2021.
- Social Community Management Plan (SCMP). Upper Cisokan Pumped Storage (UCPS) Hydropower Project 1040MW. 2020.
- Social Impact Assessment Report. Updated Environmental Assessment Physical Cultural Resources (PCR). Upper Cisokan Pumped Storage Project. 2009.
- Forest Partnership Framework in the Upper Cisokan Pumped Storage Project and its Adjacent Areas. December 2020.
- Land Acquisition and Resettlement Frameworks (LARF). January 2021.
- Biodiversity Management Plan (BMP) Upper Cisokan Pumped Storage Hydropower. Achieving Biodiversity Conservation Through Integrated Catchment Management. February 2021.

EXEC 2. PROJECT LOCATION AND COMPONENTS

The UCPS hydropower scheme is located approximately 150 km south and east from the capital city of Jakarta and 50 km from Indonesia's third largest city, Bandung (Figure 1).

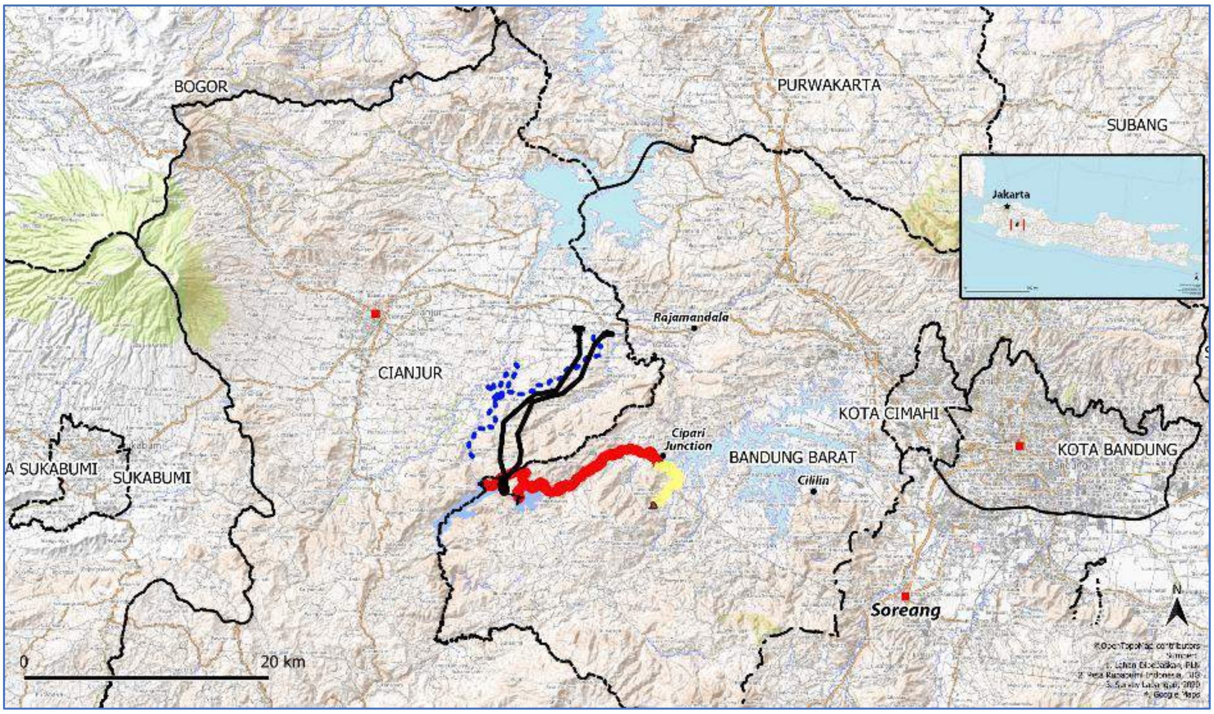


Figure 1. Location of UCPS in the Cianjur and Bandung Barat Regencies on Java, Indonesia. Showing in red and yellow the access road and in black the transmission lines

The scheme is located in the Cisokan River catchment, part of the Ciratum River catchment that flows north to the Java Sea. Four conventional hydropower and / or irrigation dams are located downstream of UCPS site or in adjacent sub-catchments; the Cisokan Weir (Cihea Irrigation Scheme), the Saguling and Cirata hydropower schemes and the Jatiluhur multipurpose scheme.

The UCPS comprises two dams and reservoirs ('upper' and 'lower'); tunnels, underground powerhouse, access roads, switchyard, quarry, temporary construction facilities (accommodation, roads, workshops, laydown areas etc.) and two 500kV transmission lines (Figure 2). The dam is located at 800m above sea level, with a 75.5 m high dam wall and a reservoir surface area of 80 ha when the water level is at maximum.

The lower dam is situated at about 460m asl on the Cisokan River (watershed area of 374 km^2) and comprises a 98 m high dam wall with a reservoir surface area at highest water level of 260 ha. The power plant, with a capacity of 1,040 MW and a pump capacity of 1,100 MW, will be built underground. Two high voltage transmission lines (15.5 km and 15.9 km) will connect the UCPS hydropower plant with the Cibinong-Saguling network in the north. A new 27 km long access road has been constructed (completed in 2019) to provide access to the construction site, and the existing 7 km long road between the quarry and the new access road has been upgraded. The existing Gunung Karang Quarry will be used as a source of rock foundation and building materials.

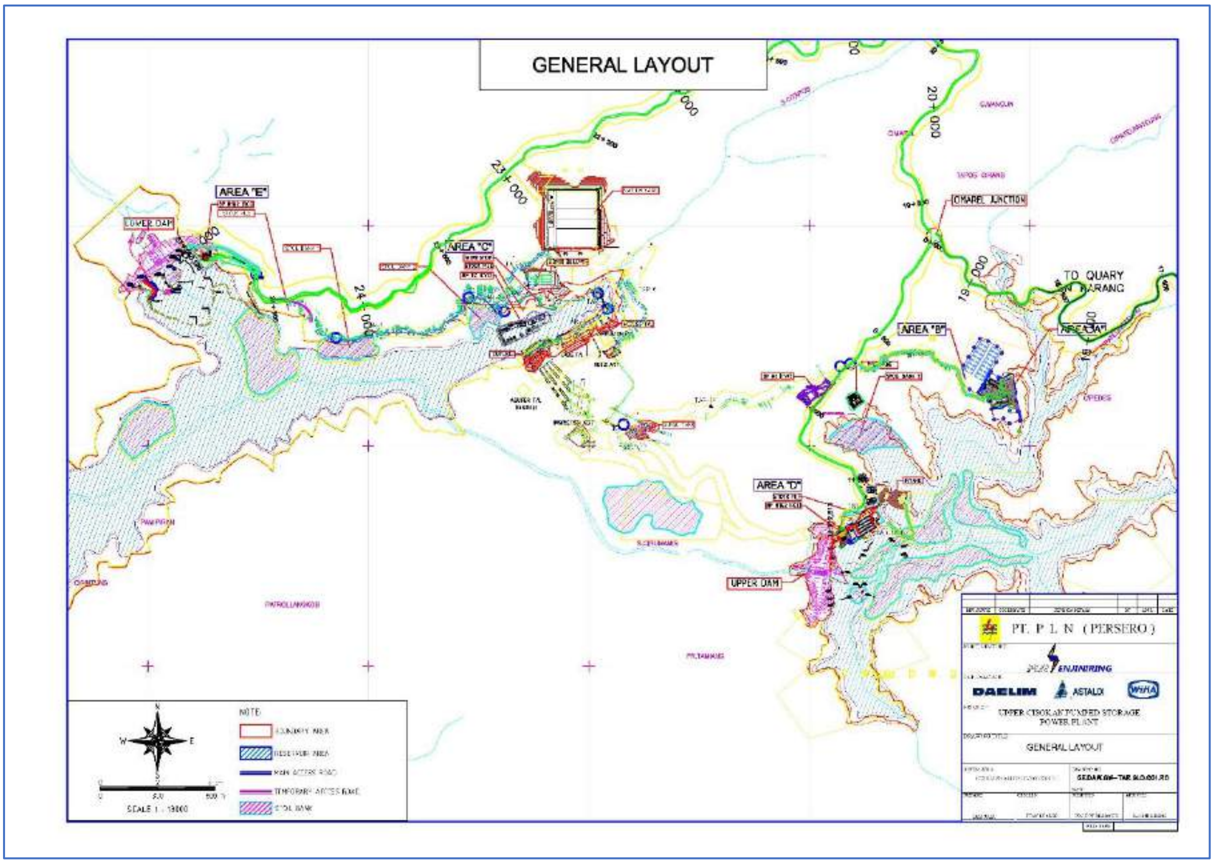


Figure 2. Layout of the Pumped Storage Scheme

The total land area required for the UCPS project is approximately 731.76 ha, consisting of 310.06 ha of privately-owned land, 12.16 ha of village treasury land, 0.54 ha of waqf land, and 409 Ha of forestry land. The total percentage of land that has been acquired by February 2021 is 721.92 ha equals to 98.65%.

During construction many temporary facilities will be required, such as accommodation and facilities for workers, workshops, offices, laydown areas, concrete batching, and temporary roads. A 20 kV grid connection will be constructed prior to UCPS construction to provide electricity during the construction period.

Exec 2.1 Purpose of the project

The objective of the UCPS scheme is to significantly increase the peaking capacity of the power generation system in Java-Bali grid in an environmentally and socially sustainable way and strengthen the institutional capacity of the project implementing entity Perusahaan Listrik Negara (PLN) in hydropower planning, development and operation.

UCPS will aim to support instantaneous balancing of electricity supply and demand, thereby maintaining power system stability, security and reliability. It will also provide the storage capacity the power system needs to enable integration of variable renewable energy such as solar and wind energy. In a pumped storage scheme, it is run as a pump station where electricity from the power system is consumed and water is pumped into an upper reservoir and stored. When energy is required by the grid, it is operated as a power generation plant where water is released through one (or more) turbines to a lower reservoir generating electricity to the grid. It can flexibly switch between the water pumping mode to a power generating mode within minutes, allowing it to quickly ramp up to full power production capacity to meet peak demand.[1] Pumped water draws from grid electricity during off-peak time, when the price of electricity is low and the system has surplus power, while electricity from a pumped storage plant is produced during peak time when the price of electricity is high and the system needs power supply. In addition to arbitrage benefits, UCPS scheme will reduce the need to use electricity at high costs from inefficient thermal plants. As a proven technology, a large-scale pumped storage plant, such as UCPS with a 1 GW capacity, when is running at power generation mode, could displace equivalent amount of electricity from thermal plant(s) that would otherwise need to be added to the grid to meet the peak demand.

UCPS scheme will also provide a number of ancillary services to the grid. The flexibility and speed of hydropower turbine operations supports frequency control, allowing for reduction in system operating costs and improving system-wide efficiency. Its ability to switch between pumping and generator modes and ability to absorb valuable reactive power (MVARs) at crucial points on the power system (when used as a Synchronous Condenser (SynCon)) help voltage regulation and stabilization, providing network control services that reduce the overall cost of dispatch and improve system stability. UCPS will provide rapid system restart (or black-start) in the event of black-out of the power system and can also provide outage insurance to cover unplanned outage of other generators or provide contracted coverage for scheduled maintenance periods of other generators.

The ancillary services provided to the grid by UCPS scheme will be particularly valuable to integration of variable renewables at large scale because of its storage capacity. The dynamic response of pumped storage plants would contribute to providing a quick response to power demand variations on the Java-Bali power system and to follow the load more accurately. These features would provide better voltage regulation and ability to stabilize the grid system by the pump-turbine spinning or performing part-load operation. In addition, pumped storage is considered more cost-efficient than battery storage and has much smaller environmental footprint than large hydropower.

Exec 2.2 History of project preparation including Bank involvement since 2009

The UCPS project has been approved and implemented based on several relevant laws and regulations applicable in Indonesia, and specifically the Decree of the Governor of West Java Number 593 / Kep-596-Pemksm / 2018 dated June 8, 2018 concerning the Third Amendment to the Decree of the Governor of West Java Number 593 /Kep.1386/Pemum/2011 concerning Stipulation of Land Acquisition Location for the Construction of the Upper Cisokan Pumped Storage (UCPS) hydropower plant in West Bandung Regency and Cianjur Regency for the UCPS hydropower plant. The Indonesian ESIA (called 'ANDAL') was prepared in 2009 and PLN since received the environmental permit from the AMDAL committee.

Engagement of the World Bank with the UCPS started in 2008 under the *Upper Cisokan Pumped Storage Hydro-Electrical (1040MW) Power Project* (P112158). The development objective was to significantly increase the peaking capacity of the power generation system in Java-Bali in an environmentally and socially sustainable way and strengthen the institutional capacity of the project implementing entity (PLN) in hydro-power planning, development and operation. A Consolidated Environmental Impact Assessment and Environmental Management Plan were published in March 2011, based on the Indonesian ANDAL ESIA and additional field surveys

[1] In comparison, a thermal (e.g., coal) plant with a steam turbine generator takes more than six hours to start its operation from cold start to full load, and its use as partial load is inefficient and highly polluting.

and consultations conducted in 2008 and 2009. This document was prepared in accordance with the World Bank safeguards policies. In 2011, three Land Acquisition and Resettlement for Project Affected People (LARAP) reports (for reservoir, access road, transmission line) were prepared at this time in accordance with World Bank safeguard policy OP4.12 Involuntary Resettlement and disclosed online. The project was approved for financing by the World Bank board in 2011. A World Bank Mid-Term Review mission was held in March 2016, five years after the project was approved. The review noted that Project implementation was significantly delayed with construction not yet started and only 5% of loan funds disbursed. This situation made it unlikely that the project's development objectives could be met by project close without significant remedial actions in areas such as procurement; project and contract management; environmental and social management; and coordination and monitoring. A partial cancellation for the Upper Cisokan component was signed by the World Bank Regional Vice President on May 2, 2017. The Project had a first restructuring approved on December 21, 2018 to a new focus reflected in the Bank's continued role in supervision of resettlement activities in compliance with the Project's LARAP and capacity building.

In 2019, more than two years after the partial cancellation of the loan, PLN has expressed interest in having Bank financing for the Project again. Concept Project Information Document and Environmental and Social Review Summary for 'Development of Pumped Storage Hydropower in Java Bali System Project (P172256)' were disclosed by the World Bank in 2020. The project environmental and social risk management instruments disclosed under P172256 are prepared for compliance with the standards in the World Bank Environmental and Social Framework.

Exec 2.3 UCPS Progress to Date

The Cisokan River was identified as a suitable area for pumped storage hydropower in 1985. A feasibility study was carried out in 1993-1995 and the first impact and environmental analysis in 1998.

Work on the detailed engineering design was undertaken from 1999 to 2002, followed by supplementary design engineering work in 2006 and 2007. From 2012 to 2013 the detailed design was updated and bid documents were subsequently prepared for the main construction works[2]. Bid document preparation, prequalification of bidders and the selection of the Contractor for the main works (upper dam, lower dam, tunnels, powerhouse, switchyard, buildings) was subsequently completed. From 2012 to 2017, PLN retained a panel of experts with expertise to review/advise in roller compacted concrete dam design, rock mechanics, engineering geology, instrumentation system design, and hydraulic structures, which reviewed, advised and signed off on key outputs. PLN also retained a panel of international and Indonesian social and environmental experts, who provided review and advisory on the implementation of the ESMP and LARAP.

The construction of UCPS hydropower plant began with the construction of a permanent access road to the main construction project site. Throughout 2012 to 2019, the land acquisition and resettlement process for the new access road and the construction process were carried out. At the same time, land acquisition, resettlement and upgrades to local roads were carried out. Land acquisition and resettlement also occurred for the dam, reservoir, power station infrastructure and transmission lines occurred from 2012 – 2019.

[2] Lot 1a Upper and Lower Dams and Lot 1b Waterways, Powerhouse, Switchyard and Buildings.

Exec 2.4 Environmental and Social Studies and Activities between 2011 and 2020 ESIA

A number of studies have contributed to environmental and social assessment and the mitigation of environmental and social impacts. PLN has had an ongoing program of recruiting external consultants and university teams to collect data, undertake studies and to monitor impacts. Consultation and engagement have been regularly carried out with the community and key stakeholders since the 1990's.

1998	ANDAL Report UCPS Cisokan (PT.PLN, 1998).
2001	ANDAL Report UCPS Cisokan Additional (PLN/Newjec Inc., 2001).
2007	ANDAL Report UCPS Cisokan (PLN/Newjec Inc., 2007b).
	ANDAL Report Transmission Line UCPS Cisokan (PLN/Newjec Inc., 2007a).
2009	Combined EIA Support Study, Biodiversity Survey (Rahmat, 2009).
2009	Physical Cultural Resources Survey.
2011	Consolidated Environmental Impact Assessment P112518.
2011	Environmental and Social Management Plan for P112518.
2011	Access Road Environmental and Social Management Plan for P112518.
2011	Land Acquisition and Resettlement Action Plans for P112518 (UCPS and transmission line).
2012	Contractor's Environmental and Social Management Plan for Access Road.
2013	Watershed Management Study Report (Watershed Management) to support Upstream Cisokan Upper Cisokan Pumped Storage (PT. Geotrav Bhuana Survey).
2014	Biodiversity Management Plan, Universitas Padjadjaran (updated in 2015).
2014	Technical analysis report and scenario development for Integrated Catchment Management in the Upper Cisokan area, West Java, Indonesia.
2014	Forest Cover survey (satellite imagery).
2015	Integrated Catchment Management Plan Upper Cisokan River Basin, West Java, Indonesia.
2016	Draft Forest Partnership Framework.
2017	Key Terrestrial Species Monitoring, Universitas Padjadjaran.
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 consultant to obtain data series from 2009 to 2019, for the environmental permit monitoring.
2019	Draft Contractor's Environmental and Social Management Plan for Upper Dam, Lower Dam, Tunnels, Powerhouse, Switchyard and Buildings.
2020	Environmental and Social Baseline Report. Upper Cisokan Pumped Storage Hydropower.
2020	Review and Update Biodiversity Management Plan (BMP) Study Upper Cisokan Pumped Storage Hydropower 1040MW. October 2020.
2021	Final Report. Review of Land Acquisition and Resettlement Action Plan (LARAP) Implementation. Upper Cisokan Pumped Storage Hydropower. January 2021.

PLN has undertaken environmental monitoring twice a year since 2012 as part of their commitment to their environmental permit and 'RKL/RPL'. This includes sampling water quality, groundwater quality, noise, air quality and carrying out biodiversity and social surveys.

A watershed study was conducted in 2014 to understand the watershed risks with erosion, sediment and changing land uses. An initial Biodiversity Management Plan was prepared in February 2014 adopting the concept of integrated catchment management to meet multiple ecological and community objectives. It was revised over the course of 2015 and a Memorandum of Understanding was signed between PLN and the State-Owned Enterprise for Forestry, Perhutani, to meet the objectives of the plan. A draft Forest Partnership Framework was prepared in parallel, in recognition that protecting forest areas required engagement with the community and protection of livelihoods. Biodiversity surveys continued between 2015 and 2018, especially focusing on species that were not well understood after the initial surveys (e.g., Slow Loris). In 2019, a review of the implementation of the Biodiversity Management Plan was conducted, including additional biodiversity surveys and collection of environmental indicator data for inclusion in the current ESIA.

During the period of 2011 to 2020, consultation with the communities has been ongoing, with many detailed consultations and negotiations with the resettled households and communities and people in the wider project area who will be affected by road use or construction related activities.

Approximately 310.14 ha of community and private land has been acquired for the UCPS hydropower plant development. Affected assets include houses, settlements, cemeteries, mosques, productive land, subsistence agriculture, fishponds and other small businesses. 1,549 households have been compensated for their land and other assets. There are 765 Household that must move from the impacted area. Approximately 409 ha of state forest land has been acquired, restricting the use of that land by locals who relied on it for agriculture, timber and non-timber forest products. The resettlement process or other social impact or compensation issues were managed through the LARAP. Implementation of the LARAPs has been reviewed by independent consultants and presented in standalone document of LARAP Implementation Review Report (2021).

EXEC 3. BASELINE ENVIRONMENTAL AND SOCIAL CONTEXT

Exec 3.1 Climate

The climate is tropical with two seasons – a wet season from December to May and a dry season from June to November. The area has an average annual rainfall of 2240 – 2450mm and average temperature of 24°C (fluctuating annually between 15°C and 35°C.) Climate change analysis indicates that average temperature will increase, the number of consecutive dry days will increase over time and a small likelihood that the consecutive wet days will decrease over time. The dry season may get longer and the potential for droughts to increase. The peak rainfall is predicted to decline.

Exec 3.2 Topography

Based on the topographic map of the Cisokan watershed, the project area is located in a steep and hilly mountainous area in the southern part of West Java. Topographic height ranges from 270.41 m to 2,075 m above sea level. The northern part of the region is the alluvial plain and the Indian Ocean in the south. Within the wider landscape, there are volcanoes and alluvial plains, including Mount Pangrango to the Northeast of the project site (Figure 3).

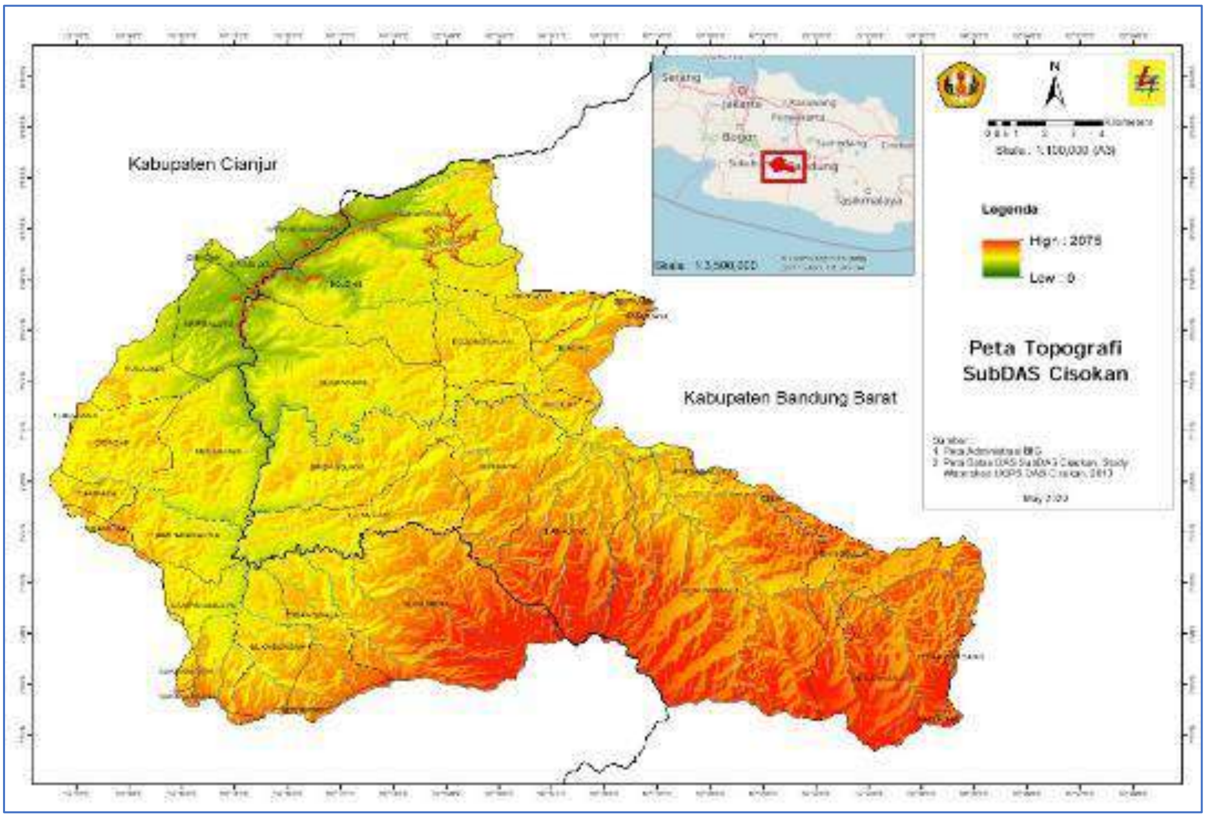


Figure 3. Topography of the Cisokan Watershed, showing in green the lower-lying parts where the UCPS project will be developed and in red the higher mountains from which the Cisokan River originates.

Exec 3.3 Terrestrial Land Cover and Biodiversity

Indonesia is among the most biologically diverse nations on Earth, ranking third behind Brazil and Colombia in total species richness, and second in terms of endemic species (Mittermeier et al. 2005; Whitten et al. 2004). The country supports the third largest expanse of tropical forest in the world (behind Brazil and the Democratic Republic of Congo). It encompasses two of the world's seven major biogeographic regions, two of the world's 25 Biodiversity Hotspots, 21 of 238 Global Ecoregions (WWF) and 23 of the world's 218 Endemic Bird Areas (BirdLife International). Indonesia contains some 17% of all known species on Earth, including an estimated 11% of the world's plant species, 12% of its mammals, 16% of all reptile and amphibian species, 17% of birds and 25% or more of all fish species (Mittermeier & Mittermeier 1998).

Because most species on Java are ecologically associated with or dependent on forests, the island's high deforestation rates are a major threat to its species. In addition, collection and hunting pressure is also high. With 58% of interviewed households on Java having had a caged bird in the past 10 years, and most birds being obtained from the wild (Jepson & Ladle 2009), it is obvious how high the collection pressure is in Indonesian forests. This also includes mammal species, such as pangolins, and reptiles such as the common gecko, which are both highly valued for the medicinal trade, and increasingly rare in the wild (Meijaard & Achdiawan 2011). Thus, there are few forests on Java that remain pristine and with a complete fauna. As a result, there are presently 44 species on Java listed as Critically Endangered or Endangered on the IUCN Red List of Threatened Species, the global authority on species conservation needs.

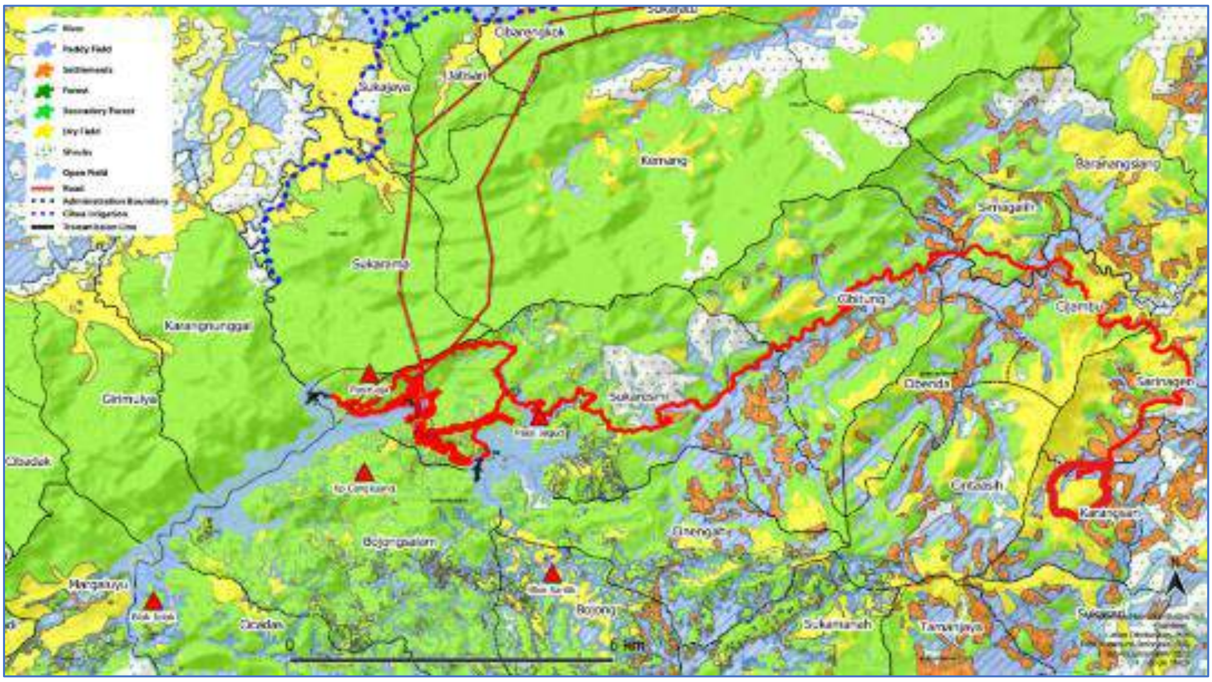


Figure 4. Land Cover in the UCPS project area (2020) showing in red the access road and quarry and the two transmission lines.

Land use in the Cisokan watershed consists of forests, gardens, settlements, rice fields, shrubs, fields and water bodies (Figure 4). The results of land use mapping as of 2020, shows that forest land area is 14,918.34 ha (40%), plantations 5,993.09 ha (16%), settlement 1,283.48 ha (3%), paddy fields 6,120.67 ha (16%), thickets 5,857.36 ha (16%), fields 3,033.84 ha (8%), and water bodies 222.65 ha (1%). Land use in the transmission line consists of forest land area of 2,201.79 ha (24.21%), secondary forest 2,813.44 ha (30.94%), shrubs 275.89 ha (3.03%), fields 302.21ha (3.32%), rice fields 2,845.95 ha (31.30%), settlements 591.22 ha (6.50%), Open land 41.85% (0.46), and water 221.04 ha (0.23%).

The analysis of the delineation of the main vegetation types in Cisokan identified several ecosystem types (or vegetation communities), including natural degraded forest, production forest (with stands of pine, teak, or *Altingia excelsa*), areas of mixed gardens or agroforestry (locally named *talun*), scrub areas, slash and burn cultivation areas that make up agricultural fields on slopes, rice fields in flat areas, and fish ponds, settlements and yards.

The human population is distributed throughout the landscape in villages (hamlets) and comprising rural families and communities with strong kinship and traditional social and cultural attitudes.

Natural degraded or secondary forest is a combination of native and non-native shrub and tree species that have grown back after land clearing, see Figure 31. Throughout the area, this vegetation can be found in fragments, usually in more steep areas where agriculture or forest cannot grow. This area includes inaccessible cliffs and riverbanks in hillside gaps and is found along the Cirumamis River between the upper and lower reservoir areas.

The state production forest in the area around the project is managed by the state forestry company on Java (Perhutani) and is dominated by pine and mahogany trees, with the ground cover in the form of grass. The production forest in the area around the project is a habitat for many wildlife species. Local people take advantage of pine trees for their sap.

Mixed garden is a land use type found between agricultural fields and plantations and forests. This type of land use serves to support food needs and provide additional income for local communities. Types of commodities grown include food crops, coffee, bananas, avocados, coconuts, bamboo and sugar palm.

The UCPS scheme qualifies as a Modified Habitat because of the significant and long-term anthropogenic interventions. The project area is contiguous with a larger landscape of >15,000 ha, with similarly disturbed vegetation types.

The presence of several Endangered and Critically Endangered species indicates Critical Habitat - Slow Loris, Grizzled Leaf Monkey, Javan Leopard, Silvery Gibbon and Javan Hawk Eagle[3]. Repeated surveys over a decade indicate that these species are widespread in the project area, suggesting that all of the landscape is Critical Habitat. The species screening process initially identified the species so far recorded in the UCPS area (near the roads, dams and reservoirs) as well as Transmission Line route, which are categorized on the IUCN Red List as Critically Endangered, Endangered or Vulnerable, endemic to Java or otherwise range-restricted, or likely to aggregate in the UCPS area during migration. Each of the species resulting from this initial screening was subsequently tested using a five criteria and threshold methodology and considering triggering as Critical Habitat if one of these thresholds is met.

Analysis of landcover change in the project area between 2016 and 2019 when limited biodiversity management actions were implemented, indicates that agroforestry areas, i.e., the core critical habitat areas are under threat. Without intervention, such trends will likely

[3] presence unclear in the project area

continue, resulting in ever smaller forest patches and more agricultural land. Assuming a constant rate of decline, the agroforest area will be reduced from 2262 ha in 2019 to less than 1,500 ha by 2050. This provides the counterfactual scenario.

Exec 3.4 River Hydrology and Biodiversity

The catchment area for the upper dam on the Cirumamis River is 10.5 km². There are several streams that flow into the Cirumamis River, such as the Cilawang, Cipateunteung, Cibima, and Cidongke. The location of Cirumamis watershed within the Cisokan watershed is presented in Figure 5.

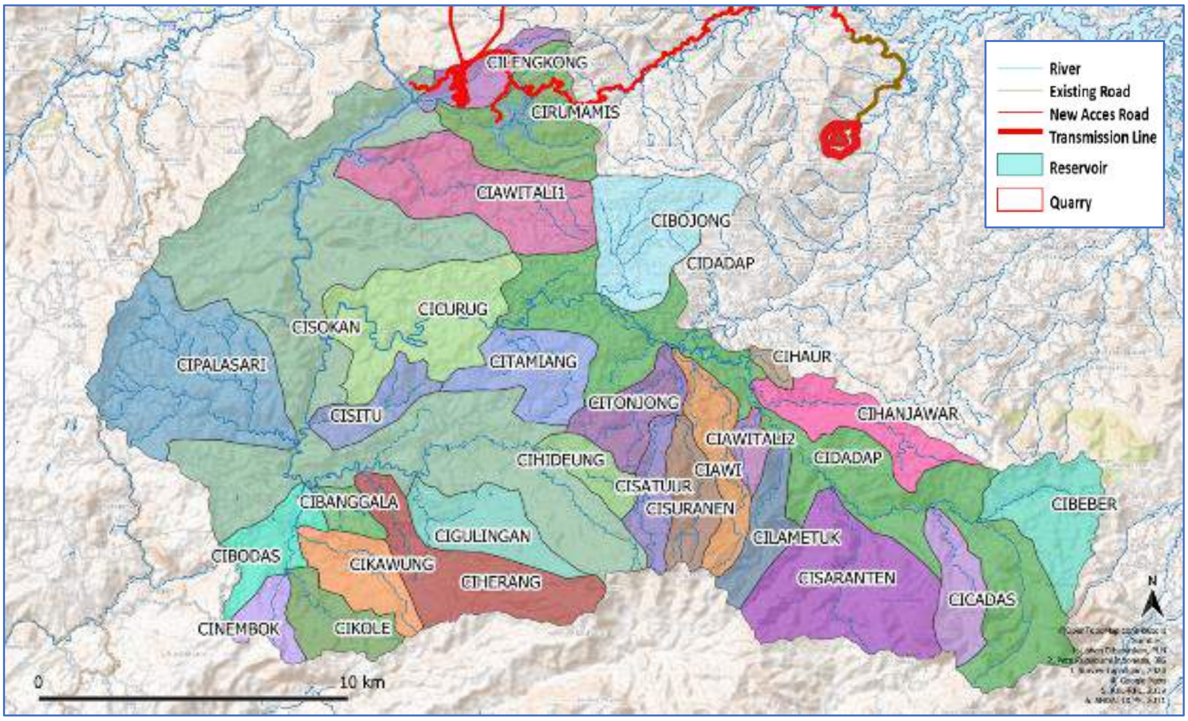


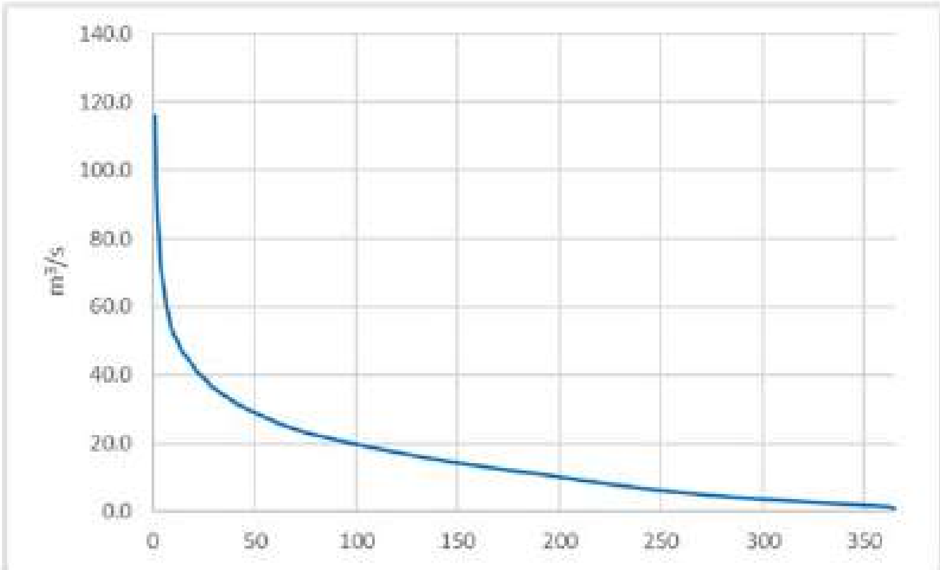
Figure 5. Cisokan River Sub-Watersheds

Cisokan River flow has been synthesized from the downstream Maglid station. The flow data presented below (Table 1) shows a distinct wet/dry season pattern of flow. The flow duration curve indicates that the river responds quickly to rainfall events and has long periods of low flow.

Table 1. Estimated Average Monthly Mean Flow Cisokan River @ Lower Dam, based on Manglid Station Data.

	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Annual
	Wet Season						Dry Season						
Average m³/s	20.76	15.82	24.05	25.45	27.20	18.10	9.94	6.70	4.58	6.54	8.56	19.81	15.55
Seasonal Average m³/s	21.90						9.36						

The range of average monthly mean flow is estimated from 4.58m^3/s in August (dry season) to 27.20m^3/s in April (Table 1), near the end of the wet season, and the annual average monthly mean flow is estimated at 15.55m^3/s. The median flow is approximately 11.4 m^3/s (based on 185 days) and 97 percentile is 1.7m^3/s.



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

Figure 6. Flow Duration Curve of Cisokan River @ Lower Dam (synthesized from Manglid Station)

Flood discharge values have been analyzed for the return period from 2 years up to 10,000 years. It is common for the Cirumamis River at the upper dam to experience flows of over 40m^3/s during rain events but rarely over 100m^3/s (Figure 6). It is common for the Cisokan River at the lower dam to experience flows of over 170m^3/s, which indicates large annual variations between low flow and high flow in response to rain events. The data shows that occasionally flood flows will exceed 450 – 500m^3/s. The 10,000 peak flood flow at the lower dam is estimated at 1,430m^3/s[4] (Table 2).

Because of the high cliffs of the Cisokan River only a handful of people have direct access to the Cisokan River either for fishing or as a means of access clean water needs. The communities in the three villages only access the Cisokan river during the dry season for bathing and washing purposes, while during the rainy season people do not access the Cisokan river water directly. The large discharge and high-water level of the Cisokan River during the rainy season are a safety concern for the community in using the Cisokan River. The surrounding community used to catch fish from the river, but not for commercial purposes. Peoples use nets, fishing lines and electric fishing gear to catch small amounts of fish. The community's location which is closer to the Cirata Reservoir makes fishermen more interested in fishing in the Cirata dam compared to the Cisokan River.

[4] This is the peak flood flow used for the design of the lower dam. It is higher than the 10,000 year return period flood peak flow of 1,069m^3/s calculated using the Indonesian government regulation regarding planned flood design discharge for dam structures, power generation and similar uses, based on SNI No. 2415:2016 (PLN Enjiniring/Nippon Koei/Newjec Inc./Indokoei International/Wiratman, 2019b).

Table 2. Probability of Flood Discharge at Any Return Period, Upper and Lower Dam

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

The main use of the Cisokan River downstream of the lower dam is as a source of irrigation water for the Cihea Irrigation Area. The Cisokan River water flow is utilized by the Cisokan Dam (local people call it the Cisuru Weir, Figure 7) where water is channeled into the Cihea irrigation as the main source of irrigation for 5,484 hectares of paddy fields in Cianjur Regency. The Cisokan Dam (Cisuru Weir) is about 3 km downstream of the UCPS lower dam.

Figure 7. Cihea Irrigation Scheme and Cisokan Dam (Cisuru Weir)

While parts of the upper river areas are in a relative natural condition, the UCPS aquatic system should be considered as modified because of the significant proportion of fish species of non-native origin (ca. 20%), with human activity having substantially modified the area's primary ecological functions through damming of the Ciratum River downstream, deforestation and agricultural land use and altering species composition through unsustainable fishing. However, there are no sensitive fish species identified in the rivers and they are not reliant on migration for their life cycle.

Exec 3.5 Settlement and Social Context

Locations of Community Settlements affected by the project, both directly and indirectly, cover 7 Districts with 2 Districts in West Bandung District, namely Rongga and Cipongkor Sub-districts, while 5 sub-districts in Cianjur District namely Cibeber, Campaka, Bojongpicung, Haurwangi and Sukaluyu Sub-districts (Figure 8). There was a change in the village area in Haurwangi, Ramasari and Sukatani Villages, at the beginning of the project the village was part of the Bojongpicung Sub-district but after the division and restructuration, it was included in the Haurwangi Sub-district.

There are several villages that affected directly by the project's land acquisition: Sukaresmi village, Bojongsalam village, Karangnunggal village and Cicadas village.

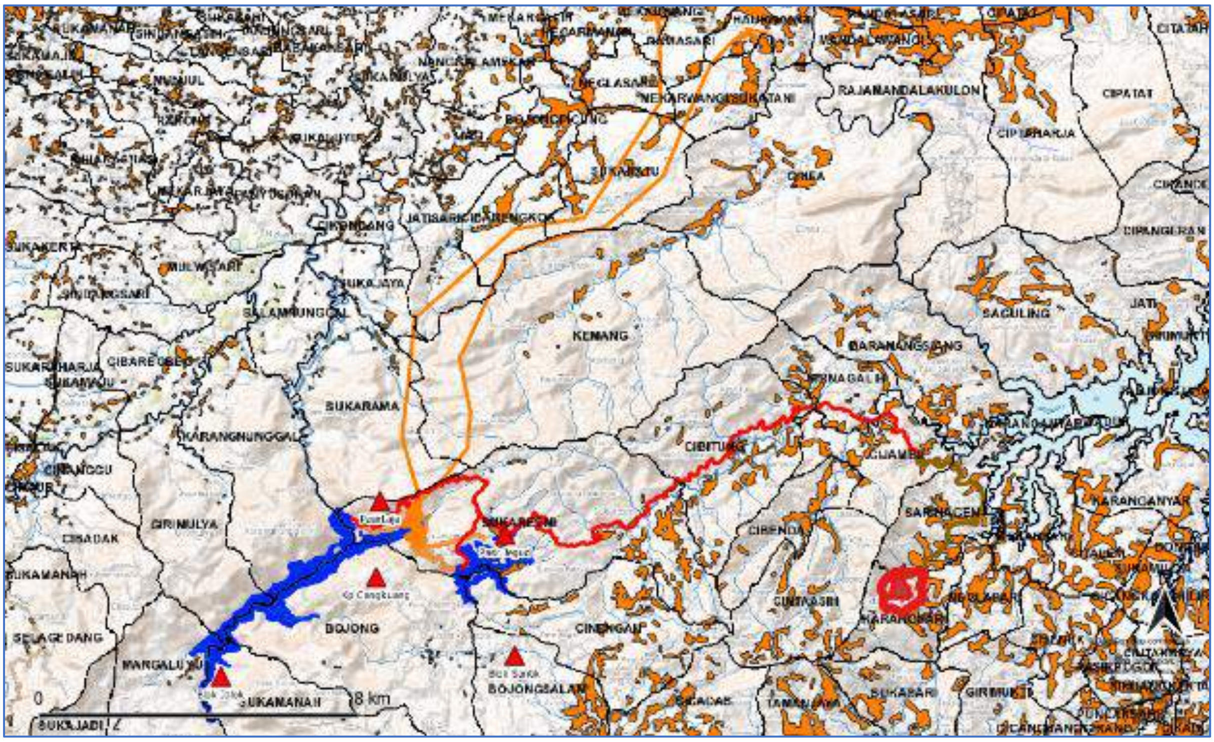


Figure 8. Settlement Patterns in the UCPS Project Area

The difference in the area of village administration and population indicates that the density (people/km^2) also varies in each village throughout the project area ranging from 242 people/km^2 (Kemang) to 2.806 people/km^2 (Haurwangi). 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.

The population is distributed throughout Kampungs (hamlets) and comprises small rural families and communities with strong kinship and traditional social and cultural attitudes. The Muslim religion strongly influences their day-to-day activities, and village and religious leaders play an essential role in decision-making, problem-solving and village development. Men are considered the heads of households, the main breadwinners and decision-makers, whilst women manage household and family matters, as well as undertaking planting and harvesting activities.

Islam is the religion that dominates and reflects everyday life, such as prayer, recitation of the Qur'an, etiquette and social interactions between communities. Sundanese cultural values are also still well preserved i.e. language for daily communication, mysticism, and customary or cultural practices such as traditional ceremonies before paddy planting season.

Various economic restoration programs which have been implemented as part of the LARAP have strengthened the existing social institutions and created new ones such as cooperatives, women group in craftsmen (banana and palm sugar processors), livestock farm groups, fishery farm groups, and handicraft centers. These institutions are considered very essential. Other social institutions are the Forest Farmers Group and the Forest Village Community Institution that were developed for the social forestry program.

EXEC 4. KEY RISKS, IMPACTS AND MITIGATION MEASURES

Exec 4.1 Changes to the river flow and habitat

River flow and habitat will be affected differently in the different phases of construction, inundation (reservoir filling) and operation. These are described below.

During construction, all flow will be diverted around the dam work areas. The Cirumamis will be diverted around the upper dam site via a chute/culvert system and the Cisokan will be diverted around the lower dam site using coffer dams and tunnel. All upstream flow will be diverted downstream and no changes to flow, energy or sediment load is anticipated. The diversion structures will restrict the movement of fish however there are no sensitive fish species identified in the rivers and they are not reliant on migration for their life cycle. The rivers are modified habitat due to the series of dams downstream, pollution downstream from Bandung and other cities, overfishing, habitat destruction, reduction in water quality and other impacts from catchment development. Diversions can also cause flooding and erosion if they are not sized correctly for the anticipated flow and scour is not managed at the tailrace. The overall impact of diversion is considered moderate and will be mitigated by the Supervision Engineer designing all diversion structures to reduce the risk of flooding and erosion and supervising the construction to meet all design requirements.

During construction sediment discharges from earthworks and tunneling will reach the rivers and tributaries unless it is well-controlled. Sediment impacts on water quality and alters instream habitat (reducing habitat for 'healthy' macroinvertebrates and affecting light, both of which affect the food chain and ecological webs). Direct impacts on tributaries and rivers from dam building, river crossings (bridges, culverts), diversion of water around work sites, slope stabilization and other activities will remove / alter riverbed and bank habitat and reduce the availability and quality of habitat in these work areas. Mitigation is the responsibility of the Contractor and they must have controls on vegetation clearance, slope and soil stabilization, stockpiles, avoiding working near or in water, sediment control and treatment devices, pollution prevention and operational procedures to ensure the effectiveness of controls.

During inundation, the hydrological regimes in the Cisokan River will be temporarily impacted when water is drawn to fill the reservoirs over an approximate four-month period in the wet season. The total amount of water to fill the dead storage of each reservoir and the active storage of the lower reservoir is 63,530,000 m^3. All Cirumamis River inflow will be passed through the upper dam to the downstream. The upper reservoir will be filled by water captured in the lower reservoir. The lower reservoir will be filled at a rate <6.21m^3/s (Table 3). All flow over this amount will be passed through the lower dam to the downstream

Table 3. Representation of Average Downstream e-flow Releases During Inundation (Wet Season)

	Dec	Jan	Feb	Mar	Apr	May
Average inflow m^3/s	20.76	15.82	24.05	25.45	27.20	18.10
UCPS intake m3/s	6.21	6.21	6.21	6.21	6.21	6.21
Downstream e-flow release	14.55	9.61	14.24	19.24	20.99	11.89

If the inflow drops below 7.91 m^3/s, the UCPS will reduce the intake to ensure that a minimum of 1.7 m^3/s is passed through the lower dam at all times. This is equivalent to the Q97 (Table 4).

Table 4. Proposed Operational Regime for Inflow and Outflow During Inundation (Wet Season)

Scenario	High flow, average flow, moderately low flow	Moderately low flow to Q97	Q97 – Q 100
Natural inflow m^3/s	>= 7.91	7.91 >< 1.97	<=1.70
Intake for UCPS Scheme m^3/s	6.21	6.21 >< 0 (Inflow - 1.70)	0
Residual flow discharge downstream lower dam m^3/s	>= 1.70 (Inflow – intake)	1.70	1.70

Unlike conventional hydro schemes, a pumped storage scheme only cycles water between reservoirs and there is no capture and storage of water for future use, and there is no net downstream discharge when generating electricity. To maintain the active storage capacity within the pumped storage system, the scheme is designed to pass excess water downstream rather than store it within the reservoirs. During operation, it is estimated that there will be only a slight change in the hydrological regime downstream as described below.

Cirumamis River:

The downstream flow in the Cirumamis River will be the same as the inflow for all flows, except if the river reduces below 0.01 m^3/s, the downstream flow releases will be maintained at 0.01 m^3/s and exceed inflow[5].

Cisokan River:

The downstream flow in the Cisokan River will be the same as the inflow for all flows except for a small amount of flow, anticipated to be 0.2 m^3/s to replenish evaporation from the two reservoirs. The required 'top up' water will have no noticeable effect on the downstream Cisokan River during most flows with the exception of extreme low flow periods (less than Q97). For example, at Q97 inflow of 1.7 m^3/s, the downstream will be 1.5 m^3/s (a reduction of 11% of flow).

In 2014, the Ministry of PUPR issued Ministerial Decree No. 619 / KPTS / M / 2014 concerning the granting of water resources utilization permits (SIPA) from the Cisokan River to PT. PLN (Persero). To maintain water availability for the purpose of river maintenance, a minimum e-flow of 0.55 m^3/s is permitted. During the dry season where the Cisokan River discharge is below 0.55 m^3/s, UCPS must discharge at least 0.55 m^3/s. Using the rationale that the scheme only takes 0.2m^3/s, this minimum e-flow would be reached when the inflow is at or below 0.75m^3/s. At flow between 0.75m^3/s and 0.55m^3/s, the 'top up' water of 0.2 m^3/s

[5] The likelihood of this low flow scenario is difficult to conclude because the natural extreme low flow conditions has not been recorded.

would be reduced until it reached 0, in order to meet this minimum e-flow. This means that the active storage would be slightly reduced during this period. At flow below 0.55m³/s the e-flow will be maintained at 0.55m³/s and water will be taken from the active storage. The chance of this happening may be one day to a few days in any one year. In extreme drought conditions, the SIPA states that the UCPS must discharge a minimum e-flow of 0.01 m³/s. This means, if the natural inflow reduces to or below 0.01 m³/s, the UCPS scheme can reduce the e-flow to no less than 0.01m³/s (Table 5).

Table: Proposed operational regime for inflow and outflow during operation

Table 5. Proposed Operational Regime for Inflow and Outflow During Operation

Scenario	All flows = >0.75	Very low flow	Q97 – Q 100	Extreme low flow
Natural inflow m³/s	>= 0.75	0.75 - 0.55	0.55 - 0.01	<0.01
Intake for UCPS Scheme m³/s	0.20	0.20 - 0 (Inflow – 0.55)	0 (water released from active storage)	0 (water released from active storage)
Residual flow discharge downstream lower dam m³/s	>= 0.55 (Inflow – intake)	0.55	0.55	0.01

The Cihea Irrigation Scheme, located 3km downstream, relies on Cisokan River water year-round for irrigation purposes. The demand is generally higher in the wet season, at a maximum of 7m³/s and lower in the dry season (as low as 0.22m³/s). The availability of water will not change for the irrigation scheme as a result of the UCPS, except if low flow conditions are experienced during the inundation phase, and during extreme low flow conditions during operation. During inundation the UCPS can be flexible and release some water if necessary, to sustain irrigation needs. During operation, the UCPS should have no impact but there may be a perception that the scheme is responsible for droughts or floods. To mitigate this PLN should develop operational criteria with the Irrigation Scheme committee.

The conclusion is that there will be a low impact on water flow in the Cirumamis and Cisokan Rivers, and at extreme low flow conditions the UCPS can release water downstream to maintain a higher than natural flow during these times.

Changes in erosion patterns and deposition may occur downstream of the Cisokan River during operations, due to reduced sediment loads. Sediment will be deposited in the upper and lower dam and only suspended sediment will be transported downstream through the spillway and outlet. This will have impacts on the rate, location and scale of erosion and sedimentation in the river bed, since river flow will be maintained, there will be increased energy in the system which is likely to cause erosion in areas that do not currently experience it. This needs to be studied further to determine the nature and scale of impact.

Exec 4.2 Key risks and impacts on terrestrial biodiversity and mitigation measures

The impact analysis concludes that in the UCPS project area, 400 ha of Critical Habitat will be directly impacted and 2,288 ha indirectly, while along the transmission line, 100 ha will be directly impacted and 341 ha indirectly. This results in total impact estimates on Critical Habitat of 500 ha of directly impacted areas and 2,629 ha of indirectly impacted areas. Taking into consideration the counterfactual trends, the area impacted is smaller, i.e., 1,867 ha.

The Biodiversity Management Plan (BMP) has been updated and supersedes the previous BMP publicly disclosed in 2011 as a sub-plan to the ESMP, as well as the BMP prepared but not published in 2015. The BMP provides practical guidance for reducing threats to biodiversity where practical, to manage identified risks, to engage with communities and stakeholders, and to pro-actively support the development of knowledge in biodiversity conservation using the ESS 6 mitigation hierarchy. Through this BMP, the aim is to engage with biodiversity professionals, government, the community, non-government organizations (NGOs), researchers and appropriate individuals to achieve a high standard of biodiversity and conservation management.

The Biodiversity Management Plan (BMP) is prepared to manage the direct and indirect impacts of the Cisokan hydropower project on the condition of biodiversity and for the maintenance of project-affected areas. It is implemented through an Integrated Catchment Management (ICM) approach that simultaneously addresses biodiversity, environmental and social aspects of landscape management.

It provides a sound rationale for a range of actions that focus on (a) Construction-related impact mitigation and management; (b) Reforestation and forest management; (c) Wildlife management; (d) Stakeholder participation; and (e) Community engagement. Within the project area of influence the BMP goals are: (i) To achieve net gain of Critical Habitat and Natural Habitat; (ii) To protect and enhance the remnant forest communities (both the habitat and wildlife) to create a self-sustaining ecosystem; (iii) To protect and increase the populations of critically endangered and endangered species so that they are self-sustaining; (iv) To take into account the ongoing threats to biodiversity conservation from the community and rural development in the selection and implementation of conservation strategies; and (v) To create a common understanding amongst stakeholders and the community about the biodiversity values and threats.

Implementation of the ICM will through a Forest Partnership Framework aims to restore a connected (agro-)forest landscape across 3,800 ha of land around the UCPS reservoirs and project facilities. The most practical way to establish the ICM program will be to pursue a collaborative forest management option between PLN, local communities and Perhutani. This strategy would build on existing land use patterns and land ownership, facilitating a relatively easy entry point to get the principal ideas of ICM established and tested.

Fifteen (15) Biodiversity Important Areas (BIA) have been identified in the immediate project area, with a total area of about 425 ha. The BIAs are presently forested islands in a non-forest landscape. They provide insufficient ecological resources to sustain viable populations of threatened species. The 3,800 ha of restoration aims to provide a **net positive gain in biodiversity values,** offsetting the 500 ha of direct impacts on critical habitat and the 2,629 ha of indirect impacts on critical habitat, or 1,867 ha under the counterfactual scenario. It simultaneously aims to restore the terrestrial biodiversity component by significantly increasing ecological connectivity among forest areas, benefiting species that trigger the Critical Habitat criteria, such as Slow Loris and Grizzled Leaf Monkey, and the aquatic habitat by improving ecological conditions alongside tributaries flowing into the reservoirs. Finally, the restoration and offsetting strategies aim to fulfil socio-economic objectives through the development of financially viable social forestry and agroforestry programs. These aim to restore original agroforestry-based land uses in the UCPS area that provide communities with improved income and reduce ecologically damaging land practices, such as open field agricultural cultivation on steep slopes.

The net gain calculation provides a buffer to allow for compensation for the rate of ongoing decline in habitat and the trajectory towards localized extinction of endemic species as a result of ongoing agricultural conversion and degradation of forest from increased population and demand for livelihoods.

Exec 4.3 Climate change risk from greenhouse gas emissions

A climate change risk assessment has been conducted and will be further updated prior to appraisal.

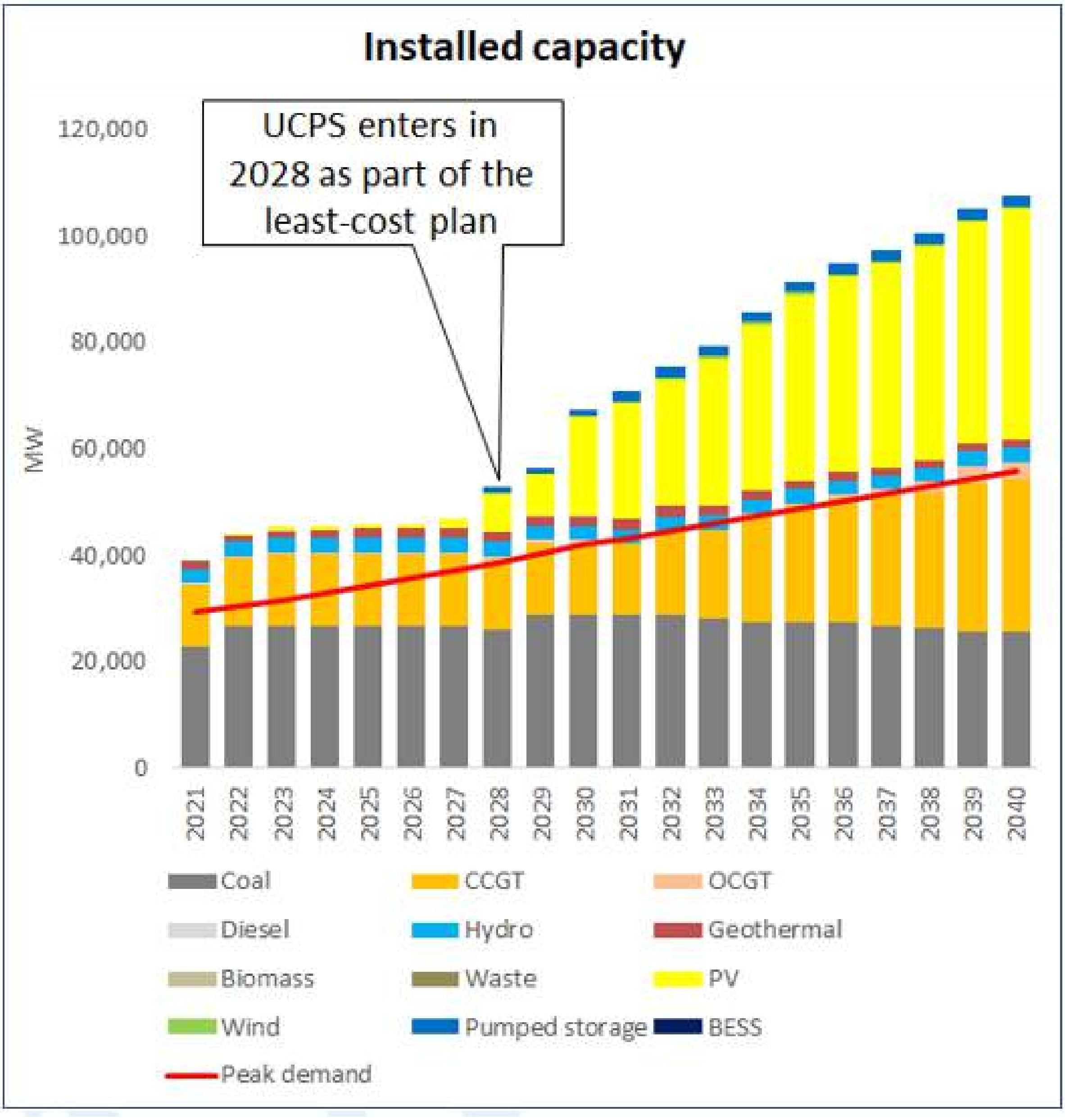


Figure 9. Long Term Development Plan for Java-Bali System

Calculation of the contribution of UCPS to greenhouse gas emissions / emissions reductions is difficult due to the complex role it will play in grid stability. As a scheme it will be a net energy consumer (pumping will require more energy than the scheme will generate). However, with pumped storage in the Java-Bali grid it will allow the more efficient use of renewable and fossil fuel generation and enable more renewable energy generation onto the grid.

The predictions on generation mix on the grid in the next 30 years is difficult to model. However, the preliminary analysis of the Long Term Least Cost Development Plan confirms that the UCPS project is part of the least cost solution with an optimal commissioning date in 2028. The storage capacity of UCPS also allow a significant increase of solar penetration in the system (40 GW) and a decrease of coal generation starting from 2028.

On the basis of this Long-Term Development Plan (Figure 9), carbon emissions of the entire system, as well as the systems emission intensity have been calculated showing that intensity will go down from about 0.75 tons of CO_2/MWh in 2028 to about 0.55 tons of CO_2/MWh in 2040. Figure 10 shows the evolution of the systems emission intensity from 2021 to 2040.

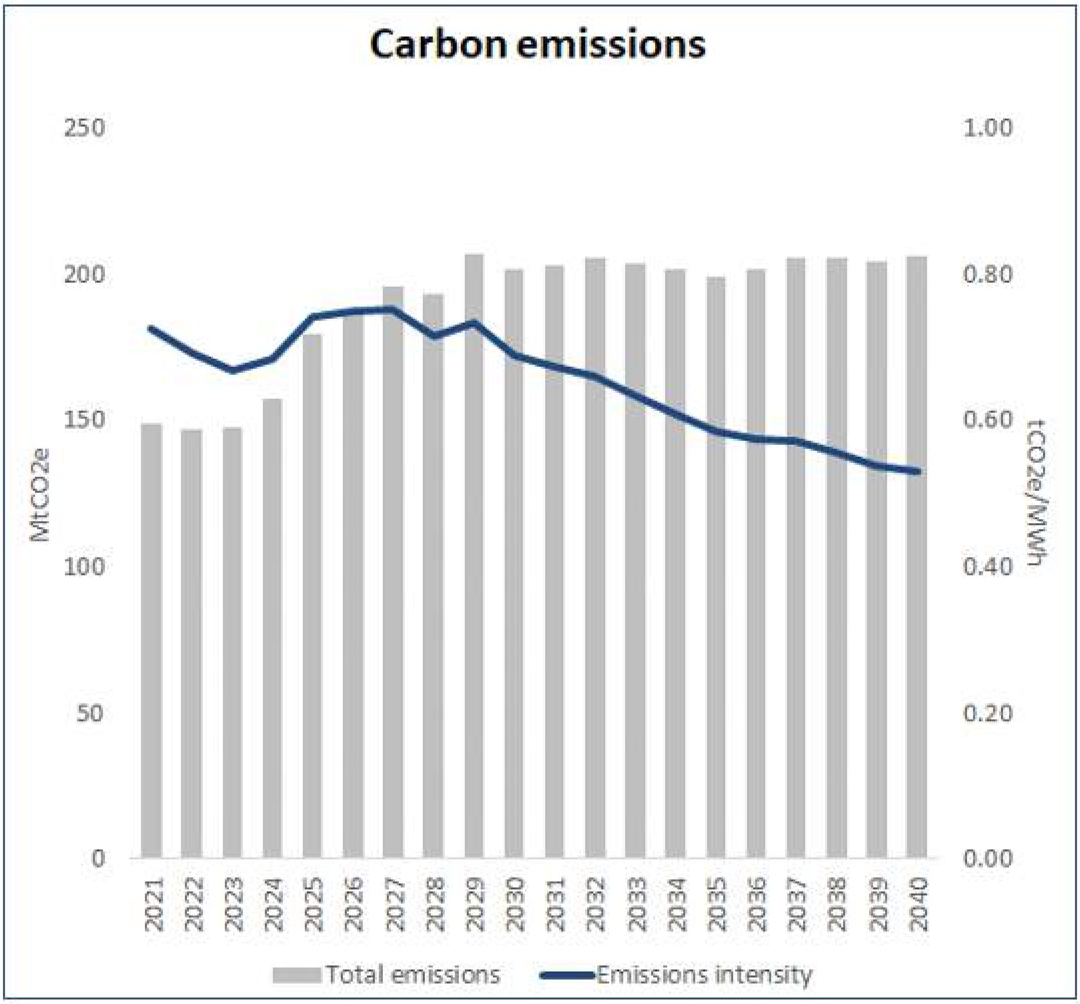


Figure 10. Java-Bali System Emission Intensity

Exec 4.4 Risks and mitigation of construction occupational health and safety

The construction phase of the UCPS as a large and complex dam construction project will come with inherent high risk work activities which must be managed through the implementation of an Occupational Health and Safety Management System with associated plans and procedures developed by the Contractors and approved by PLN and supervising engineer.

The most significant Occupational Health and Safety (OHS) hazards associated with hydropower projects occur during the construction phase and include activities with carry an extremely high risk for workers. These activities carry an elevated risk of injury or fatality if not managed adequately, these activities are:

- Working near water such as rivers and reservoirs.
- Working at heights, particularly during dam wall construction and transmission line construction and stringing.
- Working in confined spaces during tunneling for example.
- Working underground.
- Working with heavy machinery, particularly on steep and unstable slopes, tunneling, on public roads, in quarry.
- Working with explosives.
- Working on slopes and unstable ground.
- Working with low voltage and high voltage electricity.
- Using vehicles on public and project roads.
- Extended or elevated exposure to dust, noise, the sun, heat and wet weather.
- Working at night / shift work / fatigue / heat stress.
- Working with hazardous materials such as fuels, cement, and fly ash.
- Exposure to illnesses, communicable diseases, COVID-19 and others.
- Exposure to mental or physical harassment, SEA/SH, and injury from interpersonal conflicts.
- Exposure to floods, earthquakes, landslides and other natural disasters.

A number of factors will influence the construction project's success in managing these high severity risks, firstly supervision by the project owner (PLN) and its Supervision Engineer, secondly the experience and safety compliance and culture of the Contractor and its management of sub-contractors, and thirdly the level of training and skillset of the workforce.

Project workers are likely to be exposed to the above identified risks over the estimated 5 years of construction. Workers with low experience of working on large scale construction project are expected to be more vulnerable as their skillsets, experience and understanding of health and safety will probably be limited compared to the skilled workers who will have worked on similar projects and have sufficient training.

Furthermore, the project site location has limited high quality healthcare facilities which is not conducive for providing a good response to moderate to serious accidents. Community health centers in the area are not adequate to deal with emergency first-aid response or more serious accidents and the closest well-equipped hospitals are located in Bandung which is over 2 hours away by road.

Each Contractor for each package will be expected to conduct a risk identification and risk register using the Hazard Identification, Risk Analysis, and Risk Control (HIRARC) method.

The Hierarchy of Controls pyramid will form the foundation by which safety risks and hazards are managed and controlled. The most effective measure is elimination/substitution, followed by engineering controls, administrative and work practice controls and finally PPE as the least effective at the bottom.

Exec 4.5 Land Acquisition and Resettlement Impacts

Three LARAPs were prepared for the previous Cisokan Pumped Storage Project back in 2011 for the reservoirs, access roads, and the transmission lines. They were implemented during the past decade. The review of LARAPs implementation by independent consultants confirmed that delivery of compensation payments for lost assets has been largely completed. Nevertheless, there are outstanding compensation payments to be delivered related to remaining lands, cut-off/ isolated land, waqf lands and village treasury lands that emerged during the course of implementation. The LARAP implementation review report has included a proposed action plan to complete the identified outstanding tasks and issues under the new Project.

- Key findings from the review include: Access road with total of 55.41 ha have been fully acquired and 562 landowners have been fully compensated. A total of 251.85 ha owned by 891 landowners for upper and lower reservoir have been compensated. 59 landowners of total of 2.80 Ha for transmission line tower have been compensated. Only one owner (of 0.05 ha) has not received compensation as the owner lives in another province.
- The 2011 LARAP has assessed the transmission lines ROW restriction impact, identified the potentially affected households and has proposed compensation package in line with relevant GoI laws as well as World Bank OP 4.12. As commonly practiced, this payment will be delivered after the tower locations are finalized, normally after tower construction but before line stringing. Compensation payment will be calculated in accordance with Ministry of Energy and Mineral Resources Decree no 27/2018.
- Approximately 2.22 ha of unviable land (squeezed land, isolated land) as the result of the project land acquisition owned by 87 landowners have been identified in West Bandung Regency. This will need to be verified and confirmed in the next phase of the project. Identification of similar land in Cianjur Regency has not commenced. None of the unviable land has been compensated.
- Approximately 12.16 ha of village treasury land and 0.54 ha of waqf land affected by the project have not been fully compensated/ replaced. PLN has been working with local communities and administrations to address these issues and will continue the effort to complete full compensation delivery under the new project.
- There were 765 Household that must move from the impacted area. Total of 199 household in the access road were relocated within a same village while 566 households of PAPs in reservoir area must be relocated to other villages. All the PAPs opted for self-relocation mechanism so that the implementation of resettlement is fully managed by the PAPs themselves.
- There are 54 households consists of 12 HH in Upper reservoir and 42 HH in Lower reservoir who have received compensation package, chosen self-relocation but have not moved so far. The reasons vary from household to household and requires

working on a household by household basis. PLN will work with PT. Perhutani and Regency Governments to facilite and assist them in their relocation.

- The majority of the relocating households have decided and adopted self-relocation approach rather than the planned resettlement approach designed by PLN. Where the affected households have relocated on their own, the village population have grown with both host and relocated households. Some of them have met or grown close to the minimum requirements of household size under government policy for government support of infrastructure. Some of the villages have requested such support from PLN per government policy. PLN has been supporting local administrations with infrastructure support under the project. PLN will continue this support and work with local administration and local communities to extend infrastructure support to the communities in line with relevant government policies.

- In collaboration with local government and other entities, PLN has implemented economic assistance and livelihood restoration programs such as establishment of cooperatives and various capacity building programs which benefited the PAPs. Several programs designed to empower women groups which showed positive impacts in terms of increasing the role of rural women in income generating and business management.

- The review indicates that generally the affected households were able to use their land compensation money productively and PLN has implemented its various assistance activities as planned in the LARAP. The review has also identified, through its field surveys, that some relocation households are still facing difficulties in their livelihoods, some of the occupational training and assistance programs were not fully implemented or the results are not as good as expected. PLN will therefore continue its livelihood support and assistance activities under the new project.

- The construction of new roads has helped improving the livelihoods and accessibility of PAPs as new jobs emerged along the new roads.

- It is anticipated that additional lands needed by the project due to project design optimization or adjustments and additional land needed by the contractors for their construction operations. These land needs could be permanent or temporary and are expected to be in small parcels and scattered all over the project area. Details of the land needs, including location, size and timing etc. are not known at this stage. A Land Acquisition and Resettlement Framework (LARF) was prepared in line with the Environmental Social Standard 5 (ESS 5) and ESS 10 of the Environmental and Social Framework (ESF) of the World Bank, and relevant to Indonesian laws and regulations to guide the land acquisition planning for such possible needs during construction activities.

Exec 4.6 Construction worker management / influx management / community health and safety risks (including Gender-Based Violence)

For a period of at least five years, there will be hundreds of workers employed by the Contractors at any one time. Most are expected to come from elsewhere in Indonesia or overseas and will require accommodation in the Project area. During the peak construction period there will be an influx of up to 2.700 workers and estimated 4,500 – 6,000 of followers to the project area. Risks related to construction generally include noise, traffic hazards, dust health problems, and social conflict, and occupational health and safety. Management procedures of workers' barracks/basecamp, construction methods, traffic management and regulation, and community consultation have been prepared to minimize impacts associated with construction activities. A Grievance Redress Mechanism has been established to ensure that complaints are appropriately managed.

Separation from families especially among construction workers who are away from home for construction jobs may encourage undesired behaviors, such as exploitative sexual relations, and illicit sexual relations with minors from the local community. The influx of people may bring communicable diseases to the project area, including sexually transmitted diseases (STDs). Baseline assessment related to Gender Based Violence (GBV) confirmed the vulnerability of women and children to GBV attributed by several factors including low level of education, social norms, and high rate of child marriage. The project has developed a Labor Management Procedure to mitigate potential risks related to the labor and working condition issues and a GBV action plan to address potential GBV risks and impacts.

Exec 4.7 Livelihood changes in forest dependent communities

The dam will be constructed in forestry land managed by Perhutani, which will cause loss on the forestry land and consequently to the people who use the forest resource. The utilization of forest land for *huma-ladang* was carried out by approximately 1658 households in 38 hamlets. The dam construction and the establishment of the restoration area under Biodiversity Management Plan (BMP) will impact the community whose livelihood depends on the forest managed by Perhutani. The latest assessment confirmed that establishment of the Restoration Area has not impacted or at least very insignificant to the livelihood of the local people. In contrary, some activities conducted by a portion of the local people like land clearing for agriculture and or game hunting, have affected the integrity of the Restoration Area. However, future implementation of the BMP with stricter monitoring and evaluation activities may result in more significant social impacts compared to the previous period. The Project has developed a Forest Partnership Framework to mitigate potential adverse risks and impacts to the forest dependent community. The forest partnership action plan will be developed and implemented during project implementation.

Exec 4.8 Impact on Income Associated with Construction Activities

During construction the access road, community around the project area got benefits from working at construction site and opening small businesses such as food and services for the workers. Based on the LARAP midterm report in 2016, 52.33% of the respondents experienced an increase in income from economic activities surround the construction area. Project construction is expected to provide more economic opportunities for the community around the project area which will positively contributed to overall income of the community.

Exec 4.9 Community dissatisfaction and grievance mechanism.

Managing community expectations and resolving community concerns are critical for the successful implementation of the project. The latest assessment recorded that the affected communities raised several concerns regarding the project include land acquisition-related issues, expectation for labor recruitment, concerns related to health such as disturbance resulted from noise and vibration. Failure to resolve community complaints may result in project delay. PLN has developed a Stakeholder Engagement Plan (SEP) which outlines a systematic approach to promote inclusive infrastructure development by ensuring the meaningful participation of stakeholders throughout the project cycle, from planning, construction to operation. The grievance redress mechanism has been updated by taking into account lessons learned from the LARAP implementation and access road construction. A grievance Unit will be developed with clear procedure and institutional arrangement for implementation.

Exec 4.10 Cultural heritage

A comprehensive cultural heritage survey was conducted in 2009 and validated in the ESIA review in 2020. The survey was carried out in consultation with the community. None of the sites are registered with local and national authorities or have legal protection. Locations that have particular importance, 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 ustadz graves). Some buildings and graves have already been moved as part of the resettlement process. However, there are also many private graves and religious structures within the project area, but not in the project footprint, which require respect and protection during reservoir construction and preparation. Access must be maintained for pilgrims to the sacred graves.

Exec 4.11 Dam Safety

The safety of workers and the downstream communities is a critical part of the design process, construction and operational procedures. The detailed design, bid documents, prequalification of bidders and the selection of the contractor have been supervised by Project Review Panel made up of dam and geotechnical experts, during the period of 2012 to 2017. At the time, the retention and use of the panel was compliant with the World Bank safeguards policy OP.37 Safety of Dams. The panel signed off on the updated design including the instrumentation system, bid documents including quality control and assurance requirements and the prequalification of the Contractor for Lot1a Upper and Lower Dams and Lot 1b Waterways, Powerhouse, Switchyard and Buildings. PLN propose to engage a new panel for the updated UCPS project and they will be employed in a similar manner to assist in the supervision of construction, reservoir filling and commissioning and the start of operations and will be involved in the review of dam safety documents.

Dam structures and outlets have been designed to the International Commission on Large Dams (ICOLD) seismic standards. Dam structures and spillways have been designed to the 1/10,000-year flood return interval, as per the ICOLD standards, and the Indonesian government regulation regarding planned flood design discharge for dam structures, power generation and similar uses, based on SNI No. 2415:2016. Bottom outlets are designed to release water in a controlled manner quickly in cases where the dam structures are at risk of failure.

PLN has prepared a packaged dam safety plan including: i) Construction Supervision and Quality Assurance Plan, ii) Instrumentation Plan, iii) Preliminary Operation and Maintenance Plan, and iv) Broad Framework for Emergency Preparedness Plan. They are required to provide the full-fledged Operation and Maintenance Plan and Emergency Preparedness Plan to the Bank and Panel of Experts not less than 6 and 12 months prior to the initiation of the first reservoir filling.

Communities will be prohibited from approaching and using the reservoirs to protect their safety from the sudden and large daily fluctuations of water levels. The riparian areas will be replanted with native and exotic vegetation to provide slope stabilization and habitat for wild animals as part of the biodiversity enhancements under the Biodiversity Management Plan and will not be used for resettlement, forestry or for agricultural purposes. The water levels of the upper reservoir when operating fluctuate daily as high as 19 m and the lower reservoir fluctuates as high as 4.5 m. With these fluctuations, the reservoir is not safe for use by the community, or for commercial businesses such as aquaculture. People are prohibited from entering the reservoir and greenbelt areas to protect their safety from drowning. Warning alarms will be issued prior to generation or pumping, to warn of changes in reservoir water levels.

Exec 4.12 Social Benefits

The project's advantages include cheaper peak-load electricity provision and efficiency in the Java-Bali network, construction of new roads and bridges that allow access to remote hamlets and villages and provide benefits to the local economy during the Construction stage (allocation work and provision of services). The project will also stimulate economic activities during operational time and will help redirect economic activities of the Project Affected Persons (PAPs), which were originally dominated by agriculture, towards higher-earning services and trade. This is envisaged to have a positive impact, on the one hand by strengthening the rural base sector (agriculture, animal husbandry, fisheries and forestry), and, on the other hand, to grow services and trade.

Local economic benefits during the construction stage such as availability of jobs and service activities are expected to improve the communities' lives around the project area.

Exec 4.13 Environmental and Social Assessment Studies and Management Plans to be Prepared

PLN continues to assess and study environmental and social impacts and develop further mitigation and management plans as follows:

- PLN will refine and finalize the calculation of greenhouse gas emissions as per ESS3 as part of the economic analysis to be completed prior to World Bank appraisal.
- Measuring the nature and scale of impacts from reduced sediment load in the Cisokan River, sediment management in the lower reservoir and appropriate mitigation measures. This requires analysis of the proposed sediment management, surveys of baseline riverbed and bank and modelling of the likely changes in bedload, erosion potential and the identification of 'hotspots' or risk areas for erosion and deposition of sediment. Terms of reference will be prepared and technical consultants will be engaged to complete the study and prepare an impact assessment on habitat, land and river uses and develop mitigation measures for the Operational Environmental and Social Management Plan. The work is to be completed at least one year prior to reservoir filling.
- Further studies on the baseline avifauna and terrestrial biodiversity in the transmission line area of influence and any further mitigation measures regarding the location and design of transmission infrastructure to avoid animal injuries and mortalities. A terms of reference will be prepared for specialist consultants to undertake field surveys, model mortality and injury and update the biodiversity impact assessment and prepare the Transmission Line Environmental and Social Management Plan with biodiversity impact mitigation measures (and offsets, if required) as per ESS6. Work to be completed prior to the completion of the bid documents.
- A risk assessment on the significant occupational and community health and safety hazards of each of the construction packages will be prepared by PLN with the support of the Supervision Engineer, and specific instructions on the approaches to risk identification and management will be prepared for the bid documents and contracts

for future contracts and amended where necessary into the existing contracts. Risk assessments to be completed prior to the completion of the relevant bid documents for future contracts and prior to the Project effective date for existing contracts.

- A TOR will be prepared for consultants to undertake a risk assessment on the significant occupational and community health and safety hazards during operation of the hydropower scheme, transmission line and reservoirs. The consultants will prepare the health and safety management sections of the Operations and Maintenance manuals and provide training, at least one year prior to reservoir filling.
- Best practice measures for preparing the reservoir for impoundment, based on potential habitat and water quality impacts are to be developed. A terms of reference will be prepared for a consultant to review the existing land cover, hazards and risks in the reservoir and to assess the potential biodiversity and water quality impacts from impoundment and daily fluctuation of water within the reservoir and provide recommendations on environmentally and socially acceptable methods for preparing the reservoir to avoid and minimize impacts during operation. The terms of reference will include the preparation of the Reservoir Preparation Plan. Completed at least six months prior to reservoir filling.
- Update the Framework Emergency Preparedness Plan prior to appraisal to reflect the requirements of ESS4.
- Operation and Maintenance Plan and the Emergency Preparedness Plan for dam safety, as per ESS4, will be prepared by PLN and submitted to the Bank and the dam Panel of Experts not less than 6 and 12 months prior to the initiation of reservoir filling.

Exec 5. Environmental and Social Management Plan Outline

The ESMP is designed as the main document in the control plan hierarchy during the project phase (Construction and Operations). The ESMP establishes the environmental and social management framework that will be applied to the project. The plan covers Environmental and Social Principles, Communication, Reporting, Monitoring and Review Procedures that all parties must comply with, including the relevant sub-plans.

Most of the ESMP Sub-Plans, as reference below (Table 6), are updates of the Sub-plans that were prepared under the initial Bank financing, following the previous Bank safeguard guidelines. ESMP Sub-Plans are being updated or prepared to ensure full compliance with the new ESF.

Table 6. Summary of ESMP Sub-Plans

Plan	Purpose	Responsibility	Timing
Contractors Environmental and Social Management Plan	Detailed processes and procedures for management of environmental, social, security, health and safety issues.	Each Contractor for each Package will prepare their CESMP	Cleared prior to contractor mobilization
Social and Community Management Plan	Labor Management and Grievance Mechanism Stakeholder Engagement Grievance Mechanism Influx management	PLN	Finalized prior to project appraisal.
Biodiversity Management Plan	Meet the ESS6 requirements of net gain of critical habitat. Manage construction-related impacts, direct impacts from infrastructure footprint and indirect impacts from induced development.	PLN	Finalized prior to project appraisal
Reservoir Preparation Plan	Detailed methodology for preparing the land and removing contaminants prior to inundation, based on further assessment of water quality and habitat impacts and mitigation measures.	PLN, for implementation by a contractor.	Finalized at least 6 months prior to first impoundment.
Physical Cultural Resources Management Plan	Avoid and protect cultural heritage sites, and respectfully move graves and cultural sites prior to inundation.	PLN	Finalized prior to appraisal.
Transmission Line Environmental and Social Management Plan	Detailed procedures for design, construction and operation of TL.	PLN	Outline prepared prior to appraisal. Final to be completed for bid documents for design and construct TL.
Quarry Management Plan	Detailed procedures for safe and clean operation of the Gunung Karang quarry	Main Contractor, Lot 1a and Lot 1b.	Finalized prior to mobilization to site.

Downstream River Management Plan	Detailed procedures for managing downstream impacts	PLN	Finalized at least six months prior to inundation.
Operational Environmental and Social Management Plan	Detailed procedures for flow management, biodiversity management, reservoir management, stakeholder engagement	PLN	At least six months prior to inundation.

CHAPTER 1. INTRODUCTION

1.1 Overview of Hydropower and ESIA Report

The provision of electricity in Java and Bali is needed in connection with the increasing local demand for electricity. The State Electricity Company, *Perusahaan Listrik Negara* (PLN), is committed to meeting consumer demand, therefore, investment into improving electricity provision within the Java-Bali grid system is paramount. To facilitate this goal, PT PLN (Persero) plans to build a 1,040 MW Upper Cisokan Pumped Storage (UCPS) hydropower plant in the Cisokan River watershed, West Java Province. The UCPS hydropower plant will have two reservoirs (upper and lower reservoir), each with an active volume of 10,000,000 m^3. The water stored in the upper reservoir will be used to generate electrical energy, through the use of turbines, during the daily peak electricity load. Water collected in the lower reservoir will be pumped back to the upper reservoir, as long as the daily demand for electricity is low, using the electricity supply from the base load power plant. The UCPS hydropower plant will provide a more reliable electricity supply to the Java-Bali grid system at peak periods, in comparison to Fossil Fuel Power Plants/*Pembangkit Listrik Tenaga Uap* (PLTU). Collectively, Reservoirs, power station infrastructure, roads and transmission lines will occupy space or land of approximately 731.76 ha of paddy fields, fields, natural and modified forests and plantation forests.

The purpose of this ESIA report is to present the baseline conditions and the assessment of the potential environmental and social impacts that may arise from the Upper Cisokan Pumped Storage (UCPS) hydropower project during the construction, inundation, and operational phases. This ESIA is a consolidation of an earlier EIA prepared and submitted to the World Bank in 2011, and an updated assessment of environmental and social conditions in 2020. As the EIA of 2011 was prepared prior to the World Bank Environmental and Social Framework of 2018, this ESIA was also prepared in order to align and comply with the environmental and social standards (ESS1 – ESS10). The current ESIA document was updated accordingly by PLN in collaboration with Universitas Padjajaran (UNPAD).

The ESIA contains a risk assessment of potential environmental and social impacts that projects may entail, along with necessary mitigation measures to minimize potential impacts that may arise as a result of the UCPS hydropower project design, construction and operation. The Environmental and Social Management Plan (ESMP) document contains environmental and social management measures to be implemented during the preconstruction, construction and operational phases of the UCPS Hydroelectric Power Plant. This document will be used as a reference in the preparation of the Contractors-ESMP documents containing environmental and social management strategies in accordance with the detailed construction plan followed by the contractors. The ESMP contains specific sub-plans to manage significant impacts, such as the Cultural Heritage Management Plan; Social and Community Management Plan (SCMP), which contains the worker influx, labor management and stakeholder engagement activities; and the Biodiversity Management Plan highlighting measures to meet the 'net gain' habitat objectives of the World Bank Standard for biodiversity conservation.

The UCPS hydropower plant is located in the West Bandung Regency-Cianjur Regency, West Java Province, approximately 150 km from the capital city of Jakarta and 50 km from Bandung City (Figure 11).

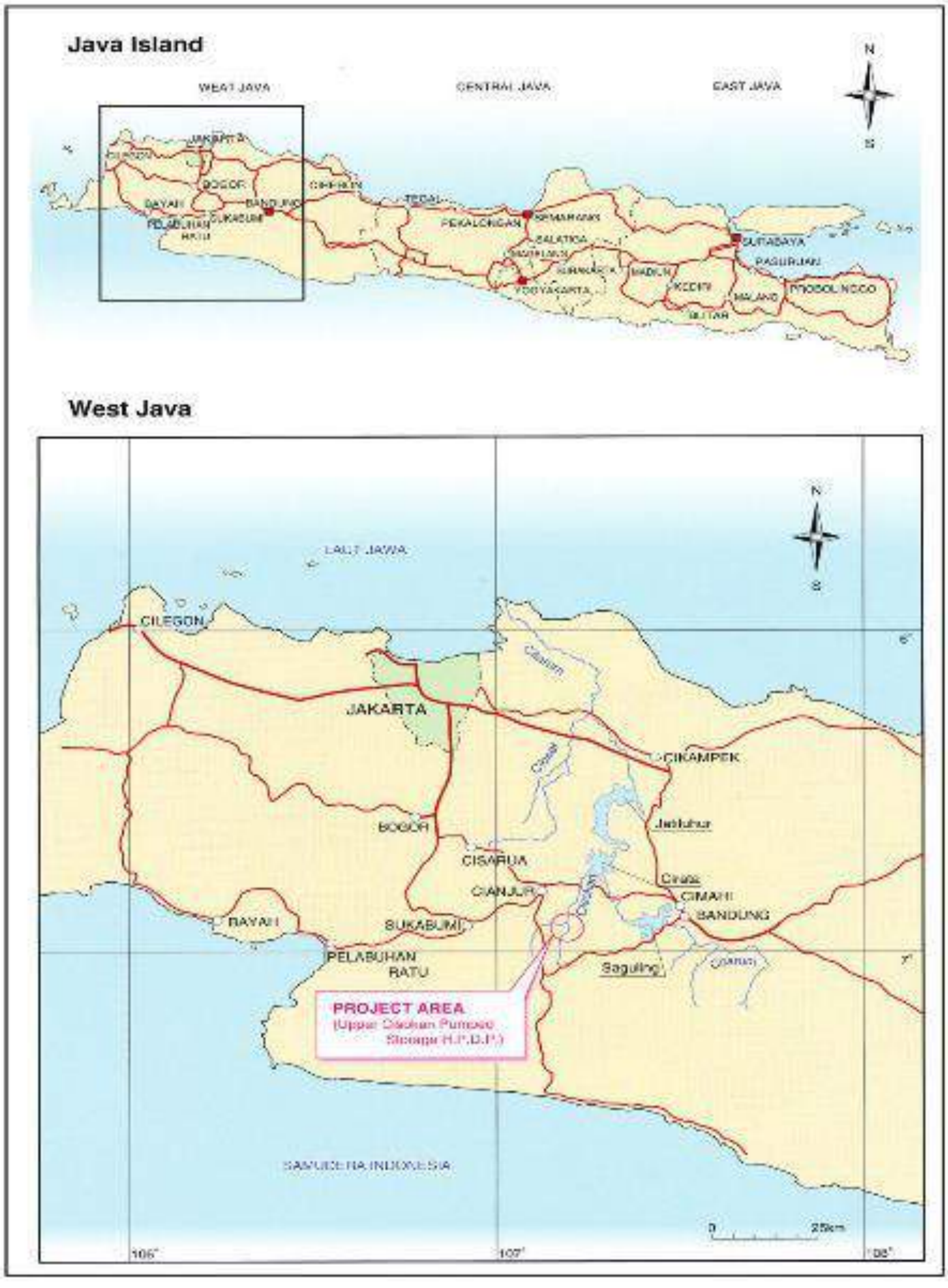


Figure 11. Map of UCPS Location on Java Island and West Java Province

Java is the center of economic activity as well as the most populous island in Indonesia. The Cisokan River flows from South to North as a tributary of the Citarum river, which flows into the Java Sea on the North Coast of Java. The Citarum River is one of the longest rivers on the island of Java. The river is host to number of hydropower plants. The closest to the Upper Cisokan hydropower plant are Cirata Hydroelectric (1,000 MW - downstream) and Saguling (700 MW - adjacent watershed).

In terms of energy generation, the UCPS hydropower construction site is an optimal location for large hydropower developments. The location is accessible to the Java-Bali electricity grid and in close proximity to two major cities on the island of Java - Jakarta and Bandung, which are the centers of industry and population in West Java.

1.2 Electricity System on the Java-Bali Grid

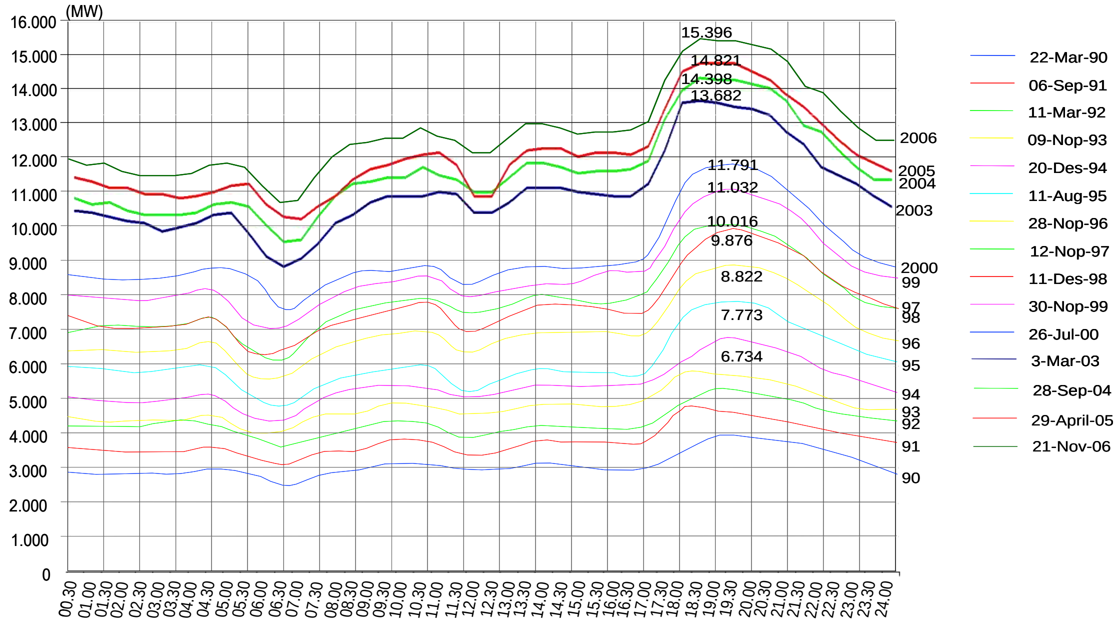
In terms of population distribution and economic activity, the grid can be divided into three distinct parts:

1. Connected Java-Bali main grid- 30,368 MW installed capacity (PLN, 2020);
2. More than 20 isolated small power grids with a power generating capacity of 12 MW to 1,500 MW in large islands outside Java and Bali; and
3. Several hundred small power plants, mostly supplying electrical energy to consumers in rural areas in and islands outside the Java-Bali area.

The electricity system in the Java-Bali network is a large and modern system. PLN has the task of providing electrical energy in Indonesia. PLN is vertically integrated with the largest generation, transmission and distribution of electricity available in Indonesia. Acting as the only legitimate buyer at the sales level, PLN buys electricity from a growing number of independent power providers and power generation companies.

Indonesia's electricity demand has grown rapidly over the past three decades, in line with economic growth. With the rebound of economic growth following the Asian Financial Crisis in early 2000, electricity demand shows higher growth than the economy, with an average growth of 4.99% per year (2000-2019. During the same period the capacity of power plants observed an average growth rate of 3.81% per year (PLN, 2020).

As consumption increases, the difference between low load and peak load also increases. In 1990, this difference measured approximately 1,450 MW. By 2019, the peak load was 28,087 MW with a daily low load of 22,000 MW and an approximate load difference of ±6000 MW (Figure 12). These trends are presented in Figure 2, outlining the daily load from 1990-2006 and peak load in 2019. The trends suggest that the future could see an increase in electrical energy demand by approximately 8,000 MW. One of the efforts to meet this growing demand is the construction of the UCPS Hydropower Plant.



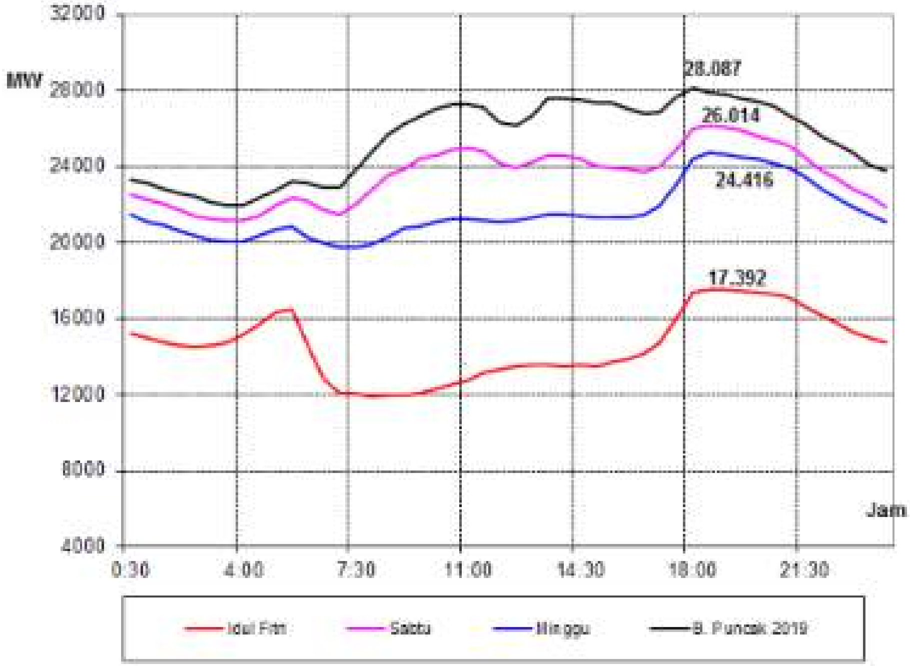


Figure 12. (a) Total Daily Electricity Charges in Java-Bali when Needs Reach the Highest Amount (1990-2006) and (b) Peak Needs in 2019.

Indonesia's generating capacity relies on the Java-Bali system. Until 2016, the portion reached 67.2 percent of the total national generating capacity. The 2017-2026 PLN Electricity Supply Business Plan (RUPTL), highlights the Java-Bali system as a priority for adding power for the next 10 years. According to the 2017-2026 RUPTL the Java-Bali system projection will progressively increase to 39.1 Giga Watt (GW). This addition has the potential to increase the generating capacity in Java-Bali to 72.2 GW in 2026. If successful, this plan will go to support industrial activity in the future.

The expected mid-term economic growth is approximately 6%. Indonesia's low electrification ratio (still among the lowest in the East Asia region) indicates that demand for electricity will continue to grow steadily. Large-scale Coal Power Plants currently provide basic energy requirements in the Java-Bali system and PLN has no plans to meet the growing electricity demand of 10,000 MW with Coal Power Plants.

1.3 UCPS Hydropower Plant and its Functions in the Java-Bali Network

The peak load electricity demand in the Java-Bali area is currently fulfilled by a combination of Fossil Fuel Power Plants, however, the use of fossil fuels for power generation is not economical because of high and fluctuating oil prices. Therefore, to overcome the increasing 'load difference' it is necessary to find a way to obtain a cheap and efficient generator, which is suitable for supplying the daily peak load needs of electricity. The best energy source that is currently suitable is hydropower with a large reservoir size. However, due to social and environmental constraints in Java (high population density and areas with high biodiversity values), **an effective peak power supply option is pumped storage. The UCPS pumped storage hydropower plant requires a smaller reservoir and watershed and requires lower construction costs than conventional hydropower dams**. Furthermore, the UCPS hydropower plant will provide more reliable electricity generation than ordinary river flow power plants, because water supply will always be available for the electricity generation process. The composition of power plants based on fuel type in the Java-Bali region is presented in Table 7.

Table 7. Composition of Power Plants by Type of Fuel in the Java-Bali Region (Gigawatt-Hour)

No.	FUEL TYPE	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
1	HSD	29.846	17.346	8.658	4.331	2.549	2.465	2.316	2.261	2.428	2.635
2	MFO	10.037	4.807	2.385	556	44	56	51	65	85	65
3	Gas	32.017	42.691	46.158	46.002	43.441	43.118	35.657	25.992	28.331	30.879
4	LNG	-	7.578	6.113	10.970	14.817	15.068	20.874	29.394	30.088	31,541
5	Batubara	93.049	110.043	134.578	151.524	163.311	178.749	193.084	207.868	221.392	238.432
6	Hydro	11.149	11.204	12.363	12.791	13.841	16.292	17.704	19.349	20.429	21.429
7	Surya/ Hybrid	2	4	4	5	6	6	6	6	7	7
8	Biomas	63	63	63	63	63	63	63	63	63	63
9	Impor	-	-	-	709	721	733	737	738	314	317
10	Geother-mal	9.033	8.650	9.828	11.939	19.814	23.078	29.405	36.302	42.828	46.005
	TOTAL	185.197	202.387	220.160	238.891	258.606	279.628	299.897	322.038	348.964	371.374

The UCPS hydropower plant will be the first hydropower plant in Indonesia to use Pumped Storage technology and will provide 1,040 MW of electricity during peak electricity usage times. The UCPS hydropower plant will require 1,000 MW of electricity to pump water from the lower reservoir to the upper reservoir for water storage. The plant will utilize excess electricity generated during periods of low electricity demand generated by the Thermal Power Plant, thereby reducing wear on power plants created by changing daily power output. This will both improve the efficiency of machine-use and make the Java-Bali electricity grid system more economic.

Table 8. Comparison of the Advantages of UCPS Pumped Storage Hydropower Plant as a Peaking Plant to Other Hydropower Plants

Description	UCPS Pumped Storage Hydropower	Saguling Hydropower	Cirata Hydropower
Power Generation Capacity	1040 MW	700 MW	1000 MW
Inundation Area	340 Ha: *Upper*: 80 Ha *Lower*: 260 Ha	4800 Ha	6200 Ha
Pumping Power Capacity	1,100 MW	0 MW	0 MW

Table 8 shows the advantages of UCPS hydropower over two similar hydropower sources concerning power capacity and inundation area. Other advantages of the UCPS hydropower plant are:

- Can be used as a 'ready-to-use' power generation facility in the event of a capacity loss problem that occurs in the power grid (due to planned or unplanned power plant outages in the system network). The UCPS hydropower plant can start operations and receive full load capacity from the power plant within minutes.
- Providing response capacity by responding appropriately to changes in power in the grid system.
- Helping to regulate the entire system frequency between 49 to 51 Hz, and maintain the voltage at a constant state. The UCPS hydropower plant will replace the Cirata hydropower plant as a power control frequency load station, which will allow conventional hydropower plants to operate with a higher efficiency factor.
- Assisting in the process of restarting the system if a system failure occurs in the network.
- Reducing dependence on oil and coal-based power plants during peak electricity usage periods and reducing PLN costs in the electricity generation process.

1.4 Main Features of UCPS Hydropower

The main features of the UCPS hydropower plant are:

- An upper dam 75.5 m high is built on the Cirumamis River, with a watershed area of approximately 10 km^2. The reservoir will have 13.47 million m^3 active storage and 14 million m_3 full storage. The reservoir surface area, when the water level is at a maximum, will be 80 ha. The fluctuation of the operational level between the highest and lowest water levels is 19 m. The upper dam body will be constructed of compacted concrete. The walls of the weir will also be reinforced to prevent erosion by water fluctuation.
- The Cirumamis e-flow will match inflow in all cases except where inflow reduces to 0.01m^3/s or below, the minimum e-flow will be maintained at 0.01m^3/s.
- A 98.0-metre tall lower dam will be built on the Cisokan River, with a watershed area of approximately 374 km^2. The reservoir will have active storage of 10 million m^3 and a full storage of 63 million m^3. The reservoir surface area at highest water level will be 260 ha. The difference in water level during operation, between the highest and lowest water levels, is 4.5 m. The dam body will be constructed from compacted concrete.
- The Cisokan e-flow will match inflow in all cases except as follows:

- During the wet season inundation period, e-flow will equal inflow minus 6.21m^3/s for all flows greater than 7.91m^3/s; e-flow will equal 1.7m^3/s for all flow lower than 7.91m^3/s.
- During operation, where inflow reduces to or below 0.75m^3/s e-flow will be 0.55m^3/s. e-flow will be 0.01m^3/s for all flow at or below 0.01m^3/s. This may reduce the active storage volume and generation capacity of UCPS during these low flow periods.

- A power plant with a capacity of 1,040 MW and a pump capacity of 1,100 MW, placed in an underground power station. Tunnels will connect the power station to the reservoirs. A switchyard and administrative office will complement the hydropower station.
- Two transmission networks connect the UCPS hydropower plant with the Cibinong-Saguling network to the north (15.5 km and 15.9 km).
- The UCPS hydropower plant will generate electricity during peak electricity demand, using base load electricity to pump water from the lower reservoir to the upper reservoir, then release the water to generate electricity
- After initial inundation, most of the water in the watershed will be passed through middle outlets and spillways, with only surface water being retained in the reservoir to compensate for evaporation losses as described above.
- A new 27 km long road has been constructed to provide access to the construction sites, and the existing 7 km long road between the Gunung Karang Quarry and the new access road has repaired.
- The existing Gunung Karang Quarry will be used as a rock foundation and dam building materials.
- A short 20 kV grid will be constructed prior to construction to help provide electricity during construction.

Major construction activities are expected to take 50 months and are planned to be operational between 2024 & 2025.

1.5 ESIA Area Definitions

The ESIA uses the following descriptions of areas:

Project Area: The Project Area is the physical footprint of all the infrastructure, reservoirs, access road, transmission lines, quarry, land acquired for re-settlement, and the 5metre buffer zone around the reservoirs.

UCPS area: Same as the Project Area

Ecological Project Area of Influence: The Ecological Project Area of Influence comprises the area of direct impacts and indirect impacts as defined in the BMP (Figure 13).

Study Area: The Study Area is the area within which the environmental and social baseline studies were conducted. This also includes the area where the AMDAL monitoring points are located (Figure 14).

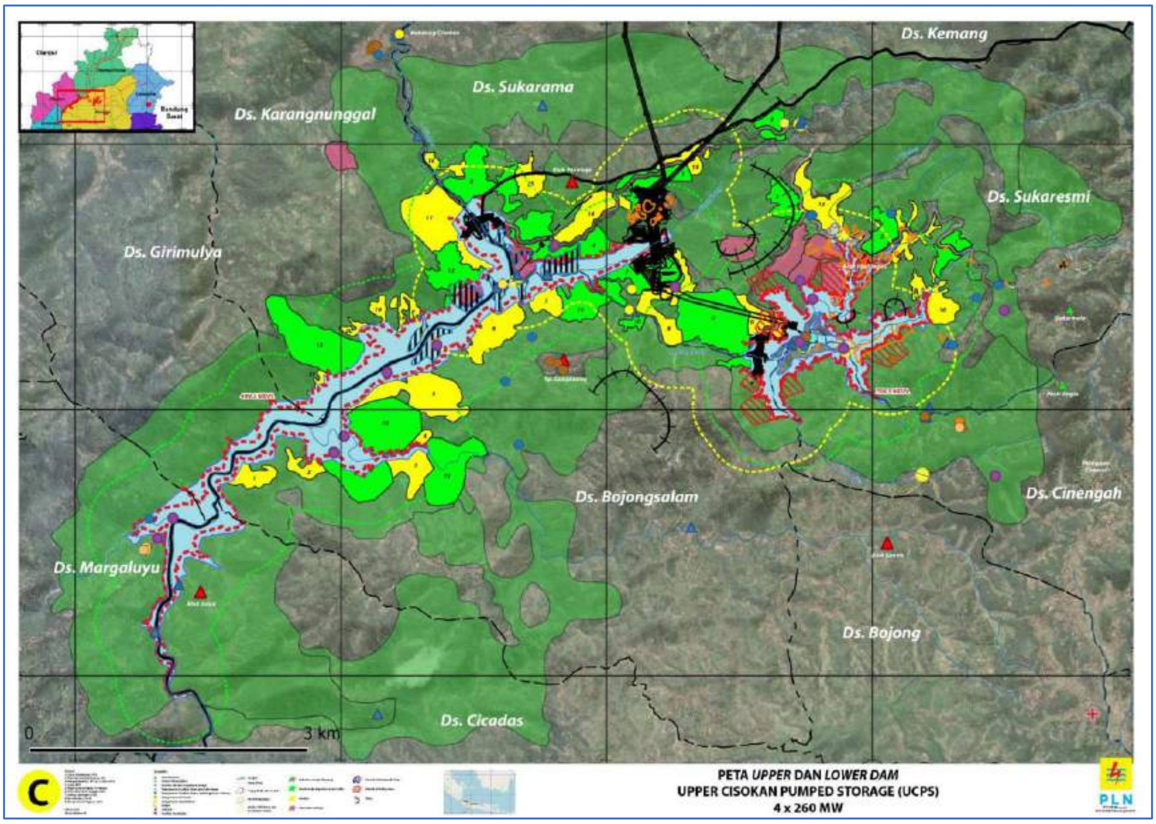


Figure 13. Ecological landscape context of the upper and lower dam areas, showing in dark green the long-term reforestation targets, in light green the core biodiversity areas (BIAs), and in yellow the biodiversity corridors

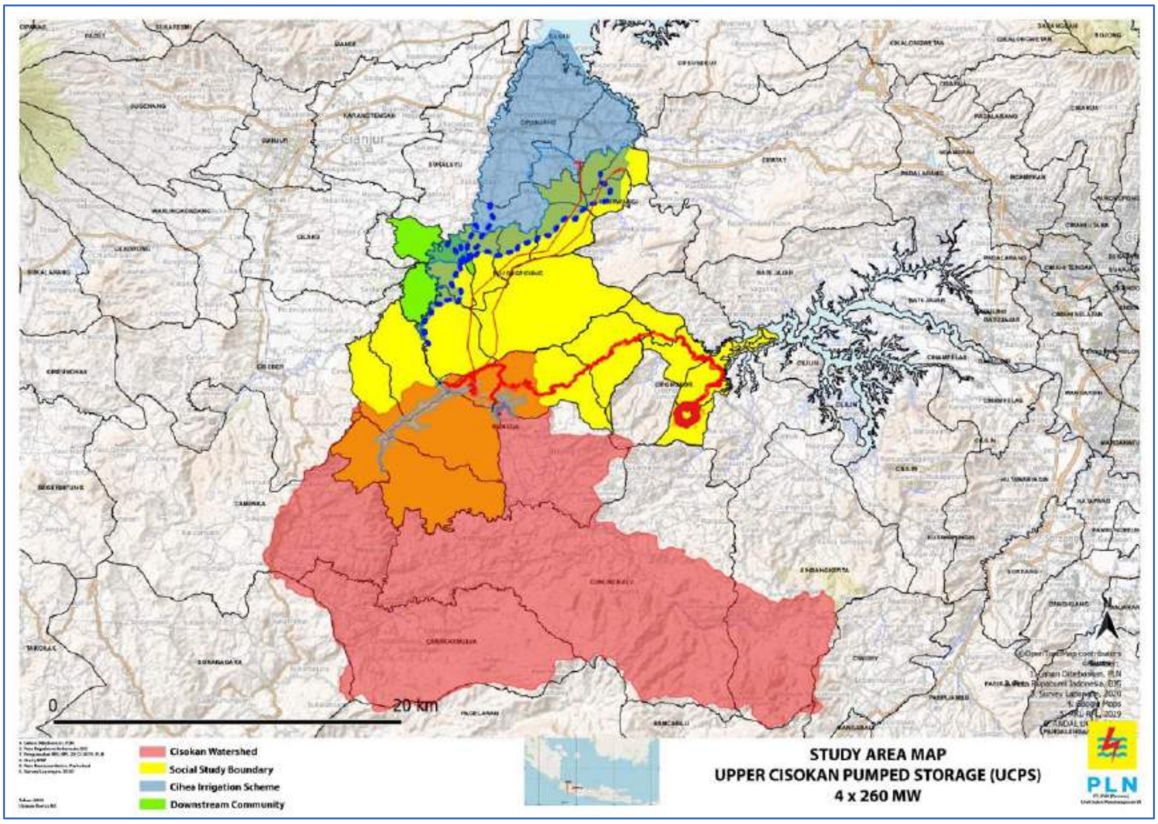


Figure 14. Boundary of Study Areas

1.6 Main Features of ESIA

The ESIA report is an updated document of previous EIA with additions and changes made in accordance with the World Bank ESF and contemporary assessment of the baseline.

The main environmental and social risks and impacts associated with the hydropower project are identified and briefly described below.

1.6.1 Resettlement

The Project requires approximately 731.76 ha of land for the access road, upper and lower reservoir, and transmission line. Identified impacts due to land acquisition include loss of land, houses/buildings/ other assets experienced by the landowners; loss of/ damage to public infrastructures such as schools, mosques, water sources, roads, bridges, sewage and water systems etc.; loss of forest land and restriction of access to forest resources. A total of 2,063 households were affected by land acquisition including private land owners and those who occupied forestry land. Out of 2,063 households, 765 households are physically displaced and required relocation. Three LARAPs were prepared for the power facility and reservoir area, the access road and transmission line. The LARAPs were under implementation since 2011 and are largely completed. Under the new project, an implementation review of three LARAPs was undertaken by independent consultants in 2020. The review concluded that the LARAPs were largely completed in terms of compensation payment delivery, household relocation and livelihood assistance program. However, the review has also identified some outstanding tasks and issues that need to be completed and addressed, such as compensation for lands above the inundation line, lands whose access will be lost due to inundation, the relocation of 54HHs have received compensation but have not relocated, delivery of livelihood assistance training activities, and additional needs of infrastructure development support in host villages that have received some relocating households. These outstanding tasks and issues need to be further checked and verified. Compensatory, mitigation and support measures need to be planned and designed in consultation with the concerned communities and local administration.

PLN has been aware of these issues and have been working with local communities and governments to address them. PLN has agreed with the bank to take a more proactive and systematic approach to screen, identify and develop a detailed action plan to complete all outstanding LARAP tasks and issues. The review report presents an action plan to carry out the detailed planning and complete outstanding tasks, including the following:

1. Carry out an identification survey in the reservoir areas and access road to screen and map out all outstanding land compensation payment issues, determine the ownership of such lands, reach a decision on their eligibility for compensation, determine the compensation rate and delivery arrangements, including a timeline.
2. Verify and update the impact assessment and census of affected households within the transmission line ROW to account for the changes that may have taken place in the past decade, update the compensation package, based on the above verification and updating, the land value changes in the past decade and the new timeline of compensation delivery. PLN will update the Transmission Line LARAP 2011.
3. Together with local administration, carry out screening and assessment of infrastructure conditions and needs in the host villages that have received Cisokan project resettler households and meet or are close to the minimum policy requirements of household size to propose a village-wise infrastructure support plan.

PLN will then implement this community infrastructure support plan as agreed and approved during the course of the project.

4. Complete relocation of 54 HHs remaining households in the reservoir areas who have received compensation package, chosen self-relocation but have not moved. PLN will work with the households and their regency governments to develop a household-wise profile to understand their circumstance, their reasons of not relocating, their plans and need of support for relocation. PLN will implement the measures and ensure all relocations are complete within the Cisokan reservoir areas.
5. Develop a post-relocation livelihood assistance program, including continuation of previously undelivered livelihood support activities, with specific measures, such as vocational training, skill development, capacity building and other forms of economic assistance. The program will include budget, schedule and detailed implementation arrangements.

It is expected that the contractor operation may require additional areas. Such land needs are expected to be in small pieces scattered in the project areas. To prepare for such eventualities, a land acquisition and resettlement framework has been developed in line with the applicable national laws and regulations and ESF ESS5 to guide resettlement planning under such situations.

1.6.2 Impact of construction activities on society

The construction period is estimated to last for at least five years. The UCPS construction will require hundreds of workers employed by the Contractors at any one time. Most are expected to come from elsewhere in Indonesia or overseas and will require accommodation in the Project area. During the peak construction there will be an influx of up to 2,700 workers and estimated 4,500-6,000 followers to the project area. Social risks related to construction may include noise, traffic hazards, dust, restriction of access to land, restricted access to infrastructure and resources, gender-based violence, and health problems, and disturbances from migrant workers and camp followers interacting with the local community.

1.6.3 Impact on River Systems

During construction, sediment discharge will affect water quality and poor flow patterns, erosion, sediment control systems, and control of work carried out on riverbank wetlands and other discharge management. This is carried out by depositing the flow from the tunnel or location potentially erosion to two or three levels of settling ponds: sedimentation control of construction is carried out through control in the construction area itself, such as sediment that occurs during tunnel excavation, causing sediment when the run-off water plant batching process carries concrete particles (cement, sand and fly ash), during the process of material crushing and addition, run-off water carries dust particles, grains of sand and soil, when draining water for temporary construction (road construction, building construction, switch yards, control building, etc.) is carried out by constructing temporary embankments and so on. Diversions will restrict the movement of fish up and down stream.

During inundation, the hydrological regimes in the Cisokan and Cirumamis Rivers will be temporarily impacted when water is drawn to fill the reservoir over a 3-4 months period. At least 0.5 m3/s will be discharged from both dams to maintain some river flow (Surat Izin Penggunaan Sumber Daya Air, 2014). To avoid a big impact due to the filling of the reservoir, filling the reservoir will be carried out during the rainy season.

During operational activities, it is estimated that there will be only a slight change in the hydrological regime downstream of the two dams, because the pumped storage scheme will recycle water between the reservoirs. The operation of the reservoir is designed to discharge water at the same rate as the inflow into the reservoir, except for small volumes to replace evaporation. During low flow periods (at or below $0.75m^3/s$, a residual flow of $0.55m^3/s$ will be released downstream). During extreme low flow periods (at or below $0.01m^3/s$), a residual flow of $0.01m^3/s$ will be released downstream. Therefore at low flow periods there will be a reduction in the water storage within the UCPS reservoirs and consequential reduction in generation capacity at the Cisokan Hydroelectric Power Plant until higher inflows are received.

Changes in erosion patterns and disposition may occur downstream of the Cisokan River during operations, due to reduced sediment loads. Sediment will be deposited in the upper and lower dam and only suspended sediment will be flown downstream through the spillway and middle outlet in lower dam.

1.6.4 Impact on Terrestrial Biodiversity

The impact analysis concludes that in the UCPS project area, 400 ha of Critical Habitat will be directly impacted and 2,288 ha indirectly, while along the transmission line, 100 ha will be directly impacted and 341 ha indirectly. This results in total impact estimates on Critical Habitat of 500 ha of directly impacted areas and 2,629 ha of indirectly impacted areas. Taking into consideration the counterfactual trends, the area impacted is smaller, i.e., 1,867 ha.

The Biodiversity Management Plan (BMP) provides practical guidance for reducing threats to biodiversity where practical, to manage identified risks, to engage with communities and stakeholders, and to pro-actively support the development of knowledge in biodiversity conservation using the ESS 6 mitigation hierarchy. The 3,800 ha of restoration aims to provide a **net positive gain in biodiversity values** and the integrated catchment management approach will enable forest-based livelihoods to thrive while protecting and enhancing forest habitat for vulnerable species.

1.6.5 Reservoir Security, Dam Safety and Management of Community Safety

Communities will be prohibited from approaching and using the reservoirs to protect their safety from the sudden and large daily fluctuations of water levels. PLN has prepared a packaged dam safety plan including: i) Construction Supervision and Quality Assurance Plan, ii) Instrumentation Plan, iii) Preliminary Operation and Maintenance Plan, and iv) Broad Framework for Emergency Preparedness Plan. They are required to provide the full-fledged Operation and Maintenance Plan and Emergency Preparedness Plan to the Bank and Panel of Experts not less than 6 and 12 months prior to the initiation of the first reservoir filling.

1.6.6 Socio-Economic Benefits

The socio-economic advantages include cheaper peak-load electricity and improved efficiency in the Java-Bali network. Construction of new roads and bridges that allow access to remote villages will also provide benefits to the local economy during the Construction stage, while the development of economic activities towards service and trade will reap benefits during operational time. The scheme will both strengthen the rural base sector (agriculture, animal husbandry, fisheries and forestry) and to grow services and trade. It is recognized in the environmental objectives of the Forest Partnership Framework that implementing significant reforestation efforts will require a change in livelihoods from ones focused on short-term income generation from annual crops to ones more focused on longer-term benefits from agroforestry.

1.7 Relationship to Programs and Other Documents

1.7.1 Previous EIA and SIA documentation

A series of environmental, social and design studies have been carried out since the first investigations in the early 1990s. This ESIA report is an updated version of previous EIA with changes made in accordance with actual conditions and information needed. The content of the ESIA combines relevant information from several previous EIA (Environmental Impact Assessment) (EIA 1991 and EIA 2001) and SIA (Social Impact Assessment) (SIA 2015) and any other technical documents reports:

- PT. PLN. 1998. Environmental Impact Analysis of UCPS HEPP West Java. Final Report.
- PT. PLN. 2001. Additional Environmental Investigation for the Detailed Design of UCPS Hydropower Plant Project.
- PLN/Newjec Inc. 2001. UCPS Hydropower Plant Project Additional Environmental Investigation. Social Acceptability Assessment.
- PLN/Newjec Inc. 2007. Environmental Impact Analysis. UCP Bandung Regency and Cianjur Regency West Java Province.
- PLN/Newjec Inc. 2007. Environmental Impact Analysis. 500kV Transmission Line Development for UCPS Hydropower Plant Bandung Regency and Cianjur Regency West Java Province.
- PLN/Newjec Inc. 2007. Social Acceptance Assessment. UCPS Bandung Regency and Cianjur Regency West Java Province.
- PLN/Newjec Inc. 2007. Supplement of Environmental Management Plan (RKL) and Environmental Monitoring Plan (RPL). 500kV Transmission Line Development for UCPS Hydropower Plant Bandung Regency and Cianjur Regency West Java Province.
- PLN. 2007. Environmental Impact Analysis (AMDAL) - UCPS Hydropower Plant.
- PLN. 2011. Revision on ANDAL UCPS Hydropower Plant with a capacity of 4x260 MW West Java Province (Access Road, Quarry, Utilization of Fly Ash).
- PLN/PT.Gamma Epsilon Consultant. 2013. Independent Monitoring Agency-IMA UCPS.
- PLN/Interdev Consultant. 2019. Social and Stakeholder Mapping Program for the UCPS 4x260 MW Hydropower Plant Project in West Bandung Regency and Cianjur Regency.

1.7.2 Environmental and Social Report

The separate reports that have been used in the preparation of this ESIA report are:

- Neneng. 2009. Social Impact Assessment Final Report. UCPS Additional Environmental Studies 2009.
- Rahmat, A. 2009. UCPSS Biodiversity Survey. UCPS Hydrpower Plant Additional Environmental Studies 2009.
- PLN. 2012-2019. RKL-RPL UCPS Hydropower Plant.

- PLN. 2012-2019. RKL-RPL 500 kV Extra High Voltage Power Line (SUTET) UCPS Hydropower Plant.
- PLN/PT GEOTRAV BHUANA SURVEY, 2013. Study of local management of river (watershed management) to support cisokan upstream UCPS Hydropower Plant, 2013.
- PLN. 2014. Biodiversity Management Plan (BMP) UCPS Hydropower Plant
- PT. LAPI ITB. 2015. Laporan Bulanan Ke-3 Pekerjaan Satuan Unit Pengaduan/GTF (Grievance Task Force) PLTA Upper Cisokan Pumped Storage. PT. PLN (Persero) UIP VI.
- Fakultas Teknologi Industri Pertanian-UNPAD. 2016. Laporan Akhir Middle Term Report Upper Cisokan Pumped Storage Hydro-Electrical Power, PT. PLN (Persero) UIP, Jawa Bagian Tengah I.
- Fakultas Teknologi Industri Pertanian-UNPAD, 2017. Laporan Akhir Independent Monitoring Agency (IMA) Upper Cisokan Pumped Storage Hydro-Electrical Power, PT. PLN (Persero) UIP, Jawa Bagian Tengah I.
- Interdev, 2019. Laporan Akhir Program Sosial dan Stakeholder Mapping Proyek PLTA UCPS 4x260 MW di Wilayah Kabupaten Bandung Barat, PT. PLN (Persero) UIP, Jawa Bagian Tengah I.
- Interdev, 2019. Laporan Akhir Program Sosial dan Stakeholder Mapping Proyek PLTA UCPS 4x260 MW di Wilayah Kabupaten Cianjur, PT. PLN (Persero) UIP, Jawa Bagian Tengah I.

1.7.3 Technical Investigation Design and Report

A number of design and technical reports have been carried out to determine the feasibility and detailed design of the UCPS hydropower plant. The main technical documents that have been used to provide information in the ESIA document are:

- PLN/Newjec Inc. 1995. Feasibility Report for the UCPS Hydropower Plant Project Development Project in the Republik of Indonesia. Final Report (Summary).
- PLN/Newjec Inc. 2002. Detailed Design Report. Volumes 1 – 13.
- PLN/Newjec Inc. 2007. Supplementary Study of UCPS Hydropower Plant Project. Volumes 1-6.
- Sinotech Engineering/Hydrochina Corp. 2013. dam Safety Plan UCPS Hydropower Plant Project.
- PLN Enjiniring/Nippon Koei/Newjec Inc./Indokoei International/Wiratman, 2019. dam Design Review Report
- PLN Enjiniring/Nippon Koei/Newjec Inc./Indokoei International/Wiratman, 2019. Engineering Services for Updating Detailed Design and Preparing Construction Drawing of UCPS Hydropower Plant Project
- PLN Enjiniring/Nippon Koei/Newjec Inc./Indokoei International/Wiratman, 2019. Hydrology Review Report
- PLN Enjiniring/Nippon Koei/Newjec Inc./Indokoei International/Wiratman, 2019. Seismology Review Report
- PLN Enjiniring/Nippon Koei/Newjec Inc./Indokoei International/Wiratman, 2019. Open Earthwork Design Review Report
- PLN Enjiniring/Nippon Koei/Newjec Inc./Indokoei International/Wiratman, 2019. Underground Structure Design Review Report
- PLN Enjiniring/Nippon Koei/Newjec Inc./Indokoei International/Wiratman, 2019. GBR Review Report for Upper and Lower dam

1.7.4 Related Programs

This ESIA document contains programs and activities that PT. PLN has carried out previously as an effort to prevent and manage negative impacts of the resettlement process, both in project areas and communities in areas where resettlement will be carried out; environmental impact monitoring through RKL-RPL; and implementation of the Biodiversity Management Plan (BMP). Since 2012, PLN has conducted monitoring through RKL-RPL twice a year around the project area.

CHAPTER 2. INSTITUTIONAL AND LEGAL FRAMEWORK

This project is located in two administrative areas in the West Java Province, namely West Bandung Regency and Cianjur Regency according to the Decree of the Governor of West Java Number 593 / Kep-596-Pemksm / 2018 dated June 8, 2018 concerning the Third Amendment to the Decree of the Governor of West Java Number 593 /Kep.1386/Pemum/2011 concerning Stipulation of Land Acquisition Location for the Construction of the Upper Cisokan Pumped Storage (UCPS) hydropower plant in West Bandung Regency and Cianjur Regency for the UCPS hydropower plant.

This project has been approved and implemented based on several relevant laws and regulations applicable in Indonesia.

The key to the laws and regulations are as follows:

- Regional Regulation No.22 of 2010 concerning the Regional Spatial Plan of West Java Province in 2009-2029
- Law of the Republic of Indonesia No. 32 of 2009 concerning Environmental Protection and Management.

Other related laws and regulations include guidelines and standards for land use, water quality, protection of endangered species, environmental management, and social aspects in relation to energy and electricity projects whose full list is listed in Annex B.

2.1 West Java Province Spatial Plan

According to Indonesian law, activities that are required to make an Environmental Impact Assessment (*AMDAL*) must see whether the activities to be carried out are in accordance with the spatial layout. If requirements are not met, these activities are rejected for the AMDAL process.

The Cisokan hydropower project activities must receive an AMDAL certification. The AMDAL activity is region-specific and must, therefore, be adjusted to the Spatial Plan for the Province of West Java, West Bandung Regency and Cianjur Regency.

Under the West Java Provincial Spatial Plan 2009-2029, the regional development regulations for West Java Province are divided into five development zones (Development Area Plans) and one special zone. The UCPS hydropower plant is located in the Sukabumi Development Zone and its surrounding area. Apart from other development problems, the direction of the development zone for Sukabumi and its surroundings is to carry out strategic infrastructure development, and to build industries that do not pollute or require excessive water abstraction.

The West Java infrastructure development plan is set out in Annex 4 of the spatial plan concept and includes plans for transportation infrastructure, water and irrigation, energy and electricity, and housing/ housing infrastructure. The development plan for energy and electricity infrastructure is as follows:

- Construction of electrical installations and distribution networks to increase and evenly distribute electricity supply to all regions of West Java.
- Renewable energy development, including:

  - geothermal,
  - micro-hydro,
  - solar and wind power, and
  - bio fuels.
- Development of non-renewable energy for electricity supply.

The basis for the West Java Provincial Regulation No. 22/2010 includes Law No.5 of 1960 concerning Basic Agrarian Basic Regulations, Law of the Republic of Indonesia No. 5 of 1990 concerning Protection of Biological Natural Resources and Their Ecosystems, Law Republic of Indonesia No.41 of 1999 concerning Forestry, and Law of the Republic of Indonesia No. 7 of 2004 concerning Water Resources. Law of the Republic of Indonesia No.7 of 2004 concerning Water Resources is currently no longer valid and has been replaced by Law of the Republic of Indonesia No.17 of 2019 concerning water resources. One of the requirements for submitting AMDAL is the suitability of the activity with the regional spatial plan.

The detailed development of UCPS hydropower plant has been included in the West Bandung Regency Spatial Plan as regulated by the West Bandung Regency Regional Regulation (Perda) No.2 of 2012 concerning the West Bandung Regency Spatial Plan for 2009 - 2029 and is also included in the Regency Spatial Plan Cianjur as regulated in the Regional Regulation (Perda) of Cianjur Regency No. 17 of 2012 concerning the 2011-2031 Cianjur Regency Spatial Plan. Thus, the construction of Upper Cisokan Pumped Storage in detail is in accordance with the West Bandung Regency Spatial Plan and the Cianjur Regency Spatial Plan.

2.2 Protection and Management of the Environment

The Environmental Impact Analysis (AMDAL) process is mandatory for every business and/ or activity that has a significant impact on the environment. This is stated in the Law of the Republic of Indonesia No.32 of 2009 concerning Environmental Protection and Management, namely in Article 22 Paragraph (1).:

> Law of the Republic of Indonesia No.32 of 2009 concerning Protection and Management of the Environment revokes Law No.23 of 1997 concerning Environmental Management. The implementation of AMDAL was originally regulated in Government Regulation PP 27 of 1999 concerning Environmental Impact Analysis. Government Regulation No.27 of 1999 was revoked and declared invalid with the promulgation of Government Regulation No.27 of 2012 concerning Environmental Permits on February 23, 2012.

Minister of Environment Regulation No.5 of 2012 is no longer valid with the enactment of Minister of Environment Regulation No.38 of 2019. The updated regulation of the Minister of Environment No.38 came into effect in. Minister of Environment Regulation No.5 of 2012 is no longer valid with the enactment of Minister of Environment Regulation No.38 of 2019. The last revision of AMDAL for Cisokan Hydroelectric Power Plant was carried out in 2011, as a result, the provisions applied in the construction of the Cisokan Hydroelectric Power Plant at that time were the Minister of Environment Regulation No.5 of 2012.

Based on the Regulation of the State Minister for the Environment of the Republic of Indonesia No. 05/2012 concerning types of business plans and/ or activities that require an environmental impact analysis in the hydropower sector as listed in Appendix I, namely:

a. dams with a height of more than or equal to 15 meters;

b. an area that is submerged in water is more than or equal to 200 hectares, and;
c. an energy capacity of more than 50 MW requires AMDAL because it has the potential to have an impact on air quality (odor and noise), water quality, flora and fauna, social, economic, and cultural aspects, especially related to land acquisition.

The UCPS hydropower plant uses a Pumped Storage system with two dams which dam the Cisokan River and Cirumamis River. The total area of inundation (immersion) for the two dams is 340 Ha. The energy capacity produced is 1,040 MW.

Based on Article 5 Paragraph (1) Government Regulation No.27 of 2012 concerning Environmental Permits that the AMDAL preparation as referred to in Article 4 Paragraph (1) is written into the AMDAL document which consists of: Terms of Reference, Andal and RKL-RPL.

ANDAL (Environmental Impact Analysis) is a careful and in-depth study of the significant impacts of a plan and/ or activity. (Article 1 Number 7 Government Regulation No.27 of 2012). RKL (Environmental Management Plan) is an effort to deal with the impact on the environment as a result of a planned business and/ or activity (Article 1 Number 8 of Government Regulation No.27 of 2012). RPL (Environmental Monitoring Plan) is an effort to monitor environmental components affected by the impact of a business plan and/ or activity.

Based on Article 2 of Government Regulation No.27 of 2012, every business and/ or activity that is required to have an AMDAL or UKL-UPL is required to have an Environmental Permit. Environmental permits are obtained through phases of activities including AMDAL and UKL-UPL preparation, AMDAL assessment and UKL-UPL inspection and application and issuance of environmental permits.

According to Article 47 Paragraph (1) Government Regulation No.27 of 2012:

a. environmental permit issued by the Minister for environmental feasibility decisions or UKL-UPL Recommendations issued by the Minister.

b. governor, for environmental feasibility decisions or UKL-UPL Recommendations issued by the governor; and c. regents/ mayors, for Decisions on Environmental Feasibility or UKL-UPL Recommendations issued by the regents/ mayors.

PT. PLN (Persero) Central Java Development Main Unit 1 has obtained an environmental permit for hydropower activities at the UCPS hydropower plant activity location with a capacity of 4 x 260 MW in West Bandung Regency and Cianjur Regency based on the Decree of the Investment and Integrated Services Office One Gate Government of West Java Province No. 660/18/11.1.02.0/DPMPTSP/2018 dated 25 May 2018.

This environmental permit comes out with due regard:

a. Letter from the Governor of West Java No.660.1/1241-BPLHD, dated 12 April 200,7 regarding the ANDAL, RKL/RPL Study Assessment for the Development of the Upper Cisokan Hydro Power Plant (Pumped Storage) in Bandung Barat and Cianjur Regency
b. Letter from the Governor of West Java No.660/1985-BPLHD, dated 21 April 2011, regarding the Revised Study Assessment for ANDAL, RKL/RPL Upper Cisokan Pumped Storage with a capacity of 4x260 MW (Intermediate Road Development

Activity Plans, construction of access roads, quarry mining and Fly Ash Utilization Coal) in West Bandung Regency and Cianjur Regency;

c. Application letter for PT PLN (Persero) Central Java Development Main Unit I No.0110/KLH.01.02/IUPJBTI/2018, dated 24 April 201,8 regarding Upper Cisokan Pumped Storage Hydropower Plant with 4x 260 MW Capacity in West Bandung and Cianjur Regencies;
d. Letter from the Head of the Office of Investment and One Stop Services of the Regional Government of West Java Province No. 503/2635/ESDA dated May 15, 2018 regarding Technical Considerations;
e. Letter from the Head of the West Java Provincial Government Environmental Service No.660.1/2588/Bid-1/2018 dated May 17, 2018.

Based on Article 49 of Government Regulation no. 27 of 2012, environmental permits that have been issued by the Minister, governors, or mayors must be announced through mass media and/ or multimedia within 5 working days of issuance.

The Environmental Permit for the UCPS hydropower plant development was announced on 6 June 2019.

The Job Creation Law simplifies both environmental and business licensing. Terms and obligations in environmental agreement remain part of the load terms and obligations in business license issued to business actors. During the permit acquisition process, business is not revoked, however, if there is a violation of conduct, as stipulated in the AMDAL document or UKL-UPL, then activities and licensing are halted.

2.3 Other Related Laws and Regulations

2.3.1 Electricity Laws and Regulations

The construction of the UCPS hydropower plant involves the supply and utilization of electricity as well as electricity support businesses. Based on Article 1 paragraph 4 of the Law of the Republic of Indonesia No. 30 of 2009, electricity generation is' the activity of producing electricity'. Article 1 paragraph 5 of the Law of the Republic of Indonesia No. 30 of 2009, defines power transmission electricity as the distribution of electricity from generation to the distribution system or to consumers, or the distribution of electricity between systems.

The construction of the UCPS hydropower plant can guarantee the availability of stable and sufficient electricity at a reasonable price. Which, in turn, is expected to improve the people's welfare and prosperity. In addition, the requirements for development permits and operating permits from UCPS hydropower plant must comply with the provisions contained in Law of the Republic of Indonesia No.30 of 2009 concerning Electricity.

Several articles in the Electricity Law were amended and abolished by the Job Creation Act, one of which is article 30 of the Electricity Law so it reads that there is compensation for owners of land and everything on it that is used either directly or indirectly for power plant construction and transmission activities.

2.3.2 Land Acquisition Legislation and Process

Land acquisition for the Project is subject to new laws and regulations. Omnibus Law (Undang Undang Cipta Kerja), Law No. 11 of 2020, especially in Chapter VIII concerning the Land

Acquisition for Development for Public Interest strengthens Law no. 2 of 2012. Law 11/2020 comes into force since the enactment of Government Regulation no. 9/2021 concerning the Implementation of Land Acquisition for Development for Public Interest on February 2, 2021. The remaining land acquisition is part of the outstanding tasks that must be carried out and completed by PLN before the commencement of construction, will be subject to this new legislation (Transitional Provisions, Article 140, Government Regulation 19/2021). All land acquisition settlements for the Cisokan Project are carried out under the new legislations.

The Policies of the Republic of Indonesia relating to the land acquisition are as follows:

1. Law No. 5/1960 concerning Basic Agrarian Regulations.
2. Law No. 2 of 2012 on Land Acquisition for Development for Public Interest.
3. Law No 11 of 2021 on Omnibus Law (Undang Undang Cipta Kerja) especially in Chapter VIII concerning Land Acquisition for Development for Public Interest
4. Government Regulation No 11 of 2021 concerning Implementation of Land Acquisition for Development for Public Interest
5. Presidential Regulation Number 62 of 2018 concerning Management of Social Impacts in the context of Provision of Land for National Development.
6. Regulation of the Minister of ATR/BPN Number 6 of 2020 concerning Provisions for the Implementation of Presidential Regulation No. 62 of 2012.
7. West Java Governor Regulation Number 32 of 2013 concerning Technical Guidelines for Implementation of Land Acquisition Preparation for Development for Public Interest.
8. Regulation of the Minister of Environment and Forestry Number P.7/MENLHK/SETJEN/KUM.1/2/2019 concerning Amendments to the Regulation of the Minister of Environment and Forestry Number P.27/MENLHK/SETJEN/KUM.1/7/2018 concerning Borrowing and Use of Forest Area Guidelines.
9. West Java Governor Regulation Number 32 of 2013 concerning Technical Guidelines for Implementing Land Preparation for Development for Public Interest.
10. Decree of the Governor of West Java 593/Kep.596-Pemksm/2018 concerning the third amendment to the Decree of the Governor of West Java Number 593/Kep.1386/Pemum/2011 concerning the Stipulation of Land Acquisition Location for Upper Cisokan Pumped Storage Hydro Power Plant Development in West Bandung and Cianjur Regency.
11. Regulation of the Director of PLN Number 0344.P/DIR/2016 concerning Small Scale Land Acquisition under 5 ha.
12. Memorandum of Understanding for West Java Provincial Government, Cianjur Regency Government, West Bandung Regency Government with PT. PLN (Persero) Regarding the CSR Program for the Construction of Upper Cisokan Pump Storage Plants Number: 671/06/Admrek/2009;671/2064/Bappeda;205.2/PRJ-34 PLN/2009;013.MoU/040/DIR/2009

2.3.3 Legislation Concerning Village Treasury Land

The construction of UCPS hydropower plant uses village treasury lands in two sub-districts, namely Cipongkor District and Rongga District, West Bandung Regency. Village treasury lands are regulated under Law Number 6 of 2014 concerning villages. Village treasury land is considered a village asset according to Article 76 paragraph (1) of the Village Law. Villages that are managed have a higher compensation value when compared to private land controlled by individuals due to the element of public interest. This is a determining factor when considering the amount of compensation for Village Treasury Land as the object of land release.

The development of the UCPS hydropower plant will affect the rural area. PLN must, therefore, pay attention to the development of villages or rural area development carried out in collaboration with the city/district government or local village government.

As explained in Article 83 paragraph 3, the Development of Rural Areas includes:

a. the utilization of the Village area in the framework of determining the development area in accordance with the Regency/City spatial layout;

b. services carried out to improve the welfare of rural communities;

c. infrastructure development, increasing rural economy, and developing appropriate technology; and

d. village community empowerment to increase access to services and economic activities.

Article 84 paragraph (1) states that the Development of Rural Areas by the Government, Provincial Government, Regency/ City Government, and/ or third parties related to the utilization of Village Assets and Village spatial planning must involve the Village Government.

The release and payment of compensation for village treasury land for Cisokan Hydroelectric Power Plant must be carried out in reference to Permendagri Number 1 of 2016. Article 33 Paragraph (2) letter b Permendagri Number 1 of 2016, states that if the replacement land is not yet available, then the replacement land is first given in the form of money. Article 33 Paragraph (2) letter c states that the replacement in the form of money, as referred to in letter b, must be used to purchase replacement land of an equivalent value. This can be interpreted as compensation for village treasury land can be made using money which goes towards buying replacement land that is equal in value to the agreed upon compensation. The next arrangement concerns the location of replacement land. Article 33 Paragraph (2) letter d, Permendagri Number 1 of 2016 states that the replacement land should be located in the local village. Article 33 Paragraph (2) letter e states that if the location of the replacement land is not available in the local Village, as referred to in letter d, the replacement land can be located in a Village in a directly adjacent a District.

If with Law 2 of 2012, the provisions for releasing village treasury lands are carried out with reference to Article 34 of the Minister of Home Affairs Regulation No.1 of 2016, which states that the implementation stages of releasing village treasury must be carried out with the permission of the respective Regional and Provincial Governors. The permission from the

Governor is the basis for the Officials Making the Land Acquisition Commitment to provide compensation to the Village for land acquisition in the form of village treasury land.

Regarding the compensation that must be made by PLN as a work provider in the construction of PLTA Cisokan, there are changes in the Job Creation Law. The changes are as follows:

> Article 46, concerning compensation for village treasury land, includes an additional change in the form of compensation. According to Article 46 paragraph (4), compensation for the object of village treasury land acquisition as referred to in paragraph (1) letter c can be given in a deep form, including:
>
> a. Money
> b. Residential land
> c. Resettlement
> d. Share ownership, and
> e. Another form agreed upon by both parties

Article 34 paragraph (2) of the Job Creation Law states that the compensation of losses is carried out based on the results of the assessment which will be submitted to the Land Institution along with the minutes of the announcement of the location for the construction of PLTA Cisokan. The compensation value is final and binding.

2.3.4 Construction Activities Legislation

Construction activities in the Upper Cisokan project, both main and supporting construction, must comply with the provisions in the Construction Services Law No.2 of 2017, which replaces Law 18 of 1999 concerning Construction Services, along with its implementing regulations.

According to Article 59 Paragraph (1) of Law No.2 of 2017, in the implementation of construction services, service users and service providers are required to meet security, safety, health and sustainability standards. Article 85 Paragraph (1) of Law No.2 of 2017 states that the public can participate in the supervision of the implementation of construction services by accessing information related to construction activities that have an impact on the interests of the community. Individuals can file complaints, lawsuits and appeals for compensation in relation to construction service activities.

Currently, PT Brantas Abipraya has initiated the construction of the 27 km access road, which will be continued by PT Pembangunan Perumahan (PP) Persero. The impacts of construction work will continue to be adressed by PT PLN (Persero) Central Java Development Main Unit 1 as long as there are still complaints from the public.

PLN must pay attention to the amendments to the Construction Services Law by the Job Creation Law to the dam construction and transmission activities that will be carried out. The elimination of several articles in the Construction Services Law, which obligates:

a. the opening of a foreign construction service representative office;
b. prioritizing the use of domestic construction materials, technology and technology transfer processes;
c. up to date to technology that is efficient and environmentally sound;

d. formation of operational cooperation with agencies from a qualified national construction service business that has a business license in every construction service business activity in Indonesia and employs more Indonesian workers than foreign workers.

2.3.5 Employment and OHS Laws and Regulations

Labor Regulations related to Occupational Health and Safety:

1. Law Number 13 of 2003 concerning Manpower:

One of the important discussions in Law Number 13 of 2003 concerning Manpower related to Cisokan Hydropower workers is the protection of occupational safety and health which are rights that must be accepted by workers and fulfilled by companies. Furthermore, is it mandatory that PLN provides protection for workers in the construction of Cisokan Hydropower. The regulations of Articles 86 and 87 of Law Number 13 of 2003 concerning Manpower Article 86 are as follows:

(1) Every worker/ laborer has the right to receive protection:

a. Occupational Health and Safety;
b. Morals; and
c. Treatment in accordance with human dignity and religious values.

(2) To protect the safety of workers/ laborers in order to achieve optimal work productivity, efforts are made to Occupational Health and Safety.

(3) The protection as meant in paragraph (1) and paragraph (2) shall be implemented in accordance with the prevailing laws and regulations.

Article 87 explains that:

(1) Every company is obligated to implement an Occupational Health and Safety management system that is integrated with the company management system.

(2) Implementation of the Occupational Health and Safety management system, as referred to in paragraph (1,) shall be regulated by a Government Regulation.

Occupational health and safety, especially in the construction of the Cisokan Hydropower system, must be implemented in accordance with the provisions of the laws and regulations regulated in Indonesia. In line with this, the International Labor Organization (ILO) also explains that the productivity achieved in carrying out work is a numerical comparison between the amount produced and the amount of each source used during production, which is fulfilled and balanced.

The implementation of occupational health and safety in the construction at Cisokan is intended to reduce the risk of infirmity due to work, control hazards in the workplace, and provide any necessary treatment and rehabilitation during the construction of Cisokan Hydropower.

All workers in the construction activities of the UCPS hydropower plant project have their normative rights following Law No.13 of 2003 concerning Manpower. Some of which have been amended by the Job Creation Act. Changes to the Manpower Law are:

a. The loss of the maximum time limit provisions in the Fixed Time Work Agreement (PKWT).
b. Permit to use foreign workers is replaced only with a plan to use foreign workers approved by the central government with the exception of startups, research, etc.
c. Overtime per day is increased from a maximum of 3 hours to 4 hours - a maximum of 18 hours a week.
d. There are 6 working days in one week and one day of rest. The provision of weekly rest for 5 working days is not regulated.
e. The elimination of the phrase "the need for a decent life" as a reference for calculating the minimum wage, which has an impact on the broader shift in the concept of wage protection.
f. Removal of restrictions on the types of work that can be outsourced.
g. The paradigm shift of termination of employment is easier because it opens the possibility of layoffs only through notification from employers to workers without prior negotiation.
h. Less government interference in industrial relations by restoring work relations to an agreement between employers and workers, such as the matter of non-permanent contracts time limit and the right to long rest that can be agreed upon in the work agreement.

2. Law Number 1 of 1970 concerning Occupational Safety

As has been explained in the protection of occupational health and safety based on Law Number 13 of 2003 concerning Manpower, a more specific arrangement or *lex specialis* that regulates worker safety in the construction of Cisokan Hydropower has been regulated in Law Number 1 of 1970 concerning Work Safety.

PLN must be in accordance with those regulations stipulated in Article 14 of Law No.1 of 1997 concerning Work Safety, namely:

a. Placing all the required work safety requirements, both for rules in the work safety legislation and all the implementing regulations that apply to the workplace concerned, in places that are easily seen and legible and according to the instructions of the supervisory officer or occupational health expert;

b. Installing, all required work safety pictures and all other guidance materials in places that are easily seen and legible according to the instructions of supervisory employees or occupational safety expert.

c. Providing free of charge, all personal protective equipment required for workers and every other person who enters the workplace, accompanied by instructions required according to the instructions of the supervisory employee or occupational safety expert.

3. Law Number 36 of 2009 concerning Health

This Law participates in regulating occupational health as referred to in the previous Law. Occupational health is regulated in Article 23 which explains that:

a. Occupational health shall be implemented to achieve optimal work productivity.
b. Occupational health includes occupational health services, prevention of occupational diseases and injury.
c. Every workplace is obligated to provide occupational health.
d. Provisions regarding occupational health, as referred to in Paragraph (2) and Paragraph (3), are stipulated by a Government Regulation.

Based on this explanation, PLN as a work provider is obliged to guarantee the work health of workers who are involved in the construction of the Cisokan hydropower.

4. Government Regulation Number 88 of 2019 concerning Occupational Health

Government Regulation Number 88 of 2019 concerning Occupational Health is the implementing regulation of Law Number 36 of 2009 concerning Health. Based on the two regulations, it is explained that Occupational Health is an effort aimed at protecting everyone who is in the workplace so that they can live free from health problems resulting from work. The definition of a workplace is any room or field, closed or open, mobile or permanent, where the worker works, or where workers often enter for business purposes and where there is a potential source of danger in accordance with the provisions of laws and regulations.

This means that the implementation of occupational health for the workforc at the construction of Cisokan Hydropower is mandatory because Article 3 of the PP on Occupational Health explains that "Occupational Health Providers as referred to in Article 2 are addressed to everyone who is under the workplace". This is also reflected in the explanation related to occupational health which has always been an integral part of the guarantee of occupational health and safety as regulated in the Manpower Act, the Occupational Safety Law and the Health Law. In addition, policies related to occupational health insurance for workers are in line with the principles in the National Health System in Indonesia.

The following is an explanation of what health insurance protection that PLN can provide to construction workers at Cisokan Hydropower, based on Article 2 of Government Regulation Number 88 of 2019 concerning Occupational Health:

Article 2

(1) The central government, regional governments and the community are responsible for implementing occupational health in an integrated, comprehensive and sustainable manner.

(2) The Occupational Health Administration as referred to in paragraph (1) includes efforts:

a. disease prevention;
b. health improvement;
c. disease management; and
d. health restoration.

(3) Efforts as referred to in paragraph (2) shall be implemented in accordance with occupational health standards.

(4) The occupational health standard as referred to in paragraph (3) shall be implemented with due observance of the National Health System and the national occupational health and safety policy in accordance with the provisions of laws and regulations.

In Government Regulation Number 88 of 2019, concerning Occupational Health, certain standards that must be upheld by occupational health providers as regulated in Articles 4,5, 6 and 7 which consist of standards for efforts to prevent occupational diseases, improve health in workplace, deal with disease for workers, as well as restore health to workers.

Furthermore, PLN as an occupational health provider based on the PP Health at work is obliged to provide supporting facilities in order to guarantee the health of workers who are tied to the construction of Cisokan Hydropower, including:

a. Human resources consisting of health workers and non-health workers as supervisors;
b. Health service facilities such as the nearest health center as a form of cooperation;
c. Occupational Health Equipment such as personal protective equipment in accordance with risk factors or occupational safety and health hazards in the Cisokan hydropower plant; and
d. Recording and reporting the implementation of occupational safety and health insurance carried out by employers and managers of work places and/ or health service facilities.

Furthermore, the recording and reporting are submitted in stages to the Central Government and Regional Governments as surveillance of the implementation of occupational health in the construction of the Cisokan Hydropower plant.

5. Law Number 40 of 2004 regarding Social Security

This Social Security Law is the basis for the guarantee of the rights that should be received by workers. Social securities, as regulated in Article 18 of Law Number 40 of 2004 cover:

a. health insurance;
b. accident insurance;
c. pension plan;
d. pension guarantee; and
e. life insurance.

Based on this Law, PLN as a work provider is obliged to guarantee the health of the workforce organized nationally based on the principles of social insurance and equity.

The health insurance that is held can be issued by PLN as a work provider with the aim of ensuring that participants get the benefits of health care and protection in meeting basic health needs. Given that Indonesia is currently experiencing the Covid-19 pandemic, health insurance needs to be improved as there are many parties in the construction of the Cisokan hydropower plant. In this case, PLN does not only provide health insurance to workers, but all family members of the participants. PLN must also provide occupational health insurance, which remains valid for a maximum of 6 (six) months, if during the construction of the Cisokan Hydropower there are workers who experience termination of employment.

The health insurance provided by PLN will be in the form of individual health services that include promotive, preventive, curative and rehabilitative services, including drugs and other medical necessities. Furthermore, it will be given to government-owned or private health facilities that collaborate with the Social Security Administering Body. Except in an emergency situation, services can be provided at health facilities that do not cooperate with the Social Security Administering Bodies.

PLN, as a work provider, must follow the work accident insurance arrangements as described in Article 29 that work accident insurance is held nationally based on the principle of social insurance, with the aim of ensuring that participants receive health service benefits and monetary compensation.

As a high-risk construction project, insurance for work accidents must be provided as a guarantee of occupational safety and health for workers in the construction of the Cisokan Hydropower. PLN must also provide benefits in the form of health services in accordance with respective medical needs and benefits in the form of cash in the event of a permanent total disability or death to the worker who has a work accident. Work accident security benefits in the form of cash are given to the heirs of workers who die or workers with disabilities according to the level of disability.

In this case, however, there are several different arrangements, as described in this Social Security Law, where participants who receive social security in the form of health insurance and work accidents are workers who have paid regular contributions as well as if there are additional family members as regulated in Article 30 of the Social Security Law. This is different from what is regulated in the Occupational Health Law, which explains that health insurance is not paid for by the worker himself but has been guaranteed by the government.

Even though there are differences in the arrangements for occupational safety and health insurance, the workforce for the construction of Cisokan Hydropower must insured by the work provider.

6. Law Number 24 of 2011 concerning Social Security Administering Bodies

In the context of implementing occupational health and safety insurance, Law Number 24 of 2011 concerning Social Security Administering Bodies has the function of administering health insurance programs. As explained in Article 14 of the BPJS Law, "everyone, including foreigners who have worked for at least 6 (six) months in Indonesia, must be a participant of the Social Security program.”.

Therefore, companies related to the workforce are required to register workers who are entitled to social security. PLN is obliged to provide occupational safety and health guarantees to the workforce of the construction of Cisokan Hydropower as regulated in Article 14 of the BPJS Law. Furthermore, it is explained in Article 15 of the BPJS Law, that:

> (1) An Employer is obliged to gradually register himself and his Workers as Participants with the BPJS in accordance with the respective Social Security program.
>
> (2) Employers, in registering as referred to in paragraph (1), are required to provide complete and correct data on themselves, their Workers and their family members to BPJS.
>
> (3) The stages referred to in paragraph (1) shall be regulated by a Presidential Regulation.

As for the company's implementation of occupational health and safety guarantees for its workers, it can be done by following the health insurance and work accident insurance and death insurance programs as described in Article 6 paragraph (1) of the BPJS Law.

7. Government Regulation Number 50 of 2012 concerning Implementation of the Occupational Health and Safety Management System

Government Regulation Number 50 of 2012 describes the Occupational Health and Safety Management System which controls risks related to work activities in order to create a safe, efficient and productive workplace. It is necessary that PLN implements this management system during the construction of the Cisokan Hydropower.

Furthermore, an Occupational Health and Safety Management System Audit will be carried out as part of a systematic and independent inspection of the fulfillment of predetermined criteria to measure the results of activities that have been planned and implemented in the application of the Occupational Health and Safety Management System in the employer company.

Based on the Elucidation of Article 5 paragraph 2 the requirements that must be fulfilled as a work provider company as follows:

Article 5 paragraph (2): The obligations referred to in paragraph (1) apply to companies:

a. employing workers / laborers at least 100 (one hundred) people; or

b. observing a high level of potential danger.

The description of work with a high level of potential danger is a company with a high risk of hazards that can cause accidents that harm human life, disrupt the production processes and pollute the work environment".

Based on the requirements described in Article 5 paragraph 2 PP Number 50 of 2012, the construction work of the Cisokan Hydropower must be accompanied by an occupational safety and health management system. Data provided by PLN shows that 2700 workers are involved in the construction of the Cisokan Hydropower, which means that requirement (a) for the implementation of Occupational Health and Safety Management System is fulfilled.

Based on the description of 'high level of potential danger' in Article 5 letter b of Government Regulation Number 50 of 2012, the construction work of Cisokan Hydropower is one of the jobs with high potential hazards because the risk of work accidents does not only cover human loss but also results in the disruption of the production process and pollution of the work environment.

Therefore, this Occupational Safety and Health Management System must be fulfilled by PLN as a work provider to prevent and reduce occupational accidents and occupational diseases by involving elements of management, workers/ laborers, and/ or trade/ labor unions. Article 6 paragraph (1), explains the necessary action PLN can take:

Article 6 paragraph (1)

a. the stipulation of OHS policies;
b. OHS planning;

c. the implementation of the OHS plan;
d. monitoring and evaluation of OHS performance; and
e. performance improvements of Occupational Health and Safety Management Systems

The explanation is as follows:

a. The Stipulation of OHS Policies

The OHS policy stipulation is carried out by PLN per Article 6 paragraph (1) letter a. The entrepreneur must at least:

a. conduct an initial review of the OHS condition which includes:

1. identification of potential hazards, risk assessment and control;
2. a comparison of the implementation of OHS with companies and other sectors that are better;
3. review of the cause and effect of a dangerous event;
4. compensation and interference as well as the results of previous assessments relating to safety; and
5. assessment of the efficiency and effectiveness of the resources provided.

b. pay attention to continuous improvement of OHS management performance; and
c. pay attention to input from workers/ labor and/ or trade/ labor unions.

The OHS policy made by the company contains a number of related issues, namely:

a. vision;
b. company objectives;
c. commitment and determination to implement the policy; and
d. framework and work program covering general and/ or operational company activities.

PLN, as a work provider, must disseminate the stipulated OHS policy to all workers/ laborers, people other than workers/ laborers who are in the company, and other related parties.

b. OHS planning

The OHS plan is prepared and stipulated by the entrepreneur with reference to the OHS policy. While preparing the OHS plan, as referred to in paragraph (2), the entrepreneur must consider:

a. the results of the initial review;
b. identification of potential hazards, risk assessment and control;
c. laws, regulations and other requirements; and
d. resources owned.

When compiling an OSH plan, PLN must involve an OSH Expert, an OHS Advisory Committee, workers / labor representatives, and other parties involved in the company.

The OHS plan contains:

a. goals and objectives;
b. a priority scale;
c. hazard control efforts;
d. the determination of resources;

2.3.6 Quarry Mining Regulations

The construction of the UCPS hydropower plant dam uses granite taken from Gunung Karang owned by PT Indonesia Power's SHGB. Quarry mining is included in the category of rock mining commodity, as per Article 2 Paragraph (2) letter d of Government Regulation No. 23/2010 concerning the Implementation of Mineral and Coal Mining Business Activities. This government regulation is a mandatory rule from Law No.4 of 2009 concerning Minerals and Coal (Minerba). Law No.4 of 2009 has been amended by Law No.3 of 2020.

In mining and quarry transportation activities, PLN and contractors must pay attention to the provisions of the Minerba Law which has been partially amended by the Job Creation Law.

PT. PLN (Persero) has a Cooperation Agreement with PT Indonesia Power Saguling Power Generation and Operation & Maintenance Unit regarding land use and quarry of Gunung Karang. The quarry is located in Karangsari Village, Cipongkor District, West Bandung Regency and will serve for Purposes of Construction of PT PLN's UCPS hydropower plant Central Java Development Main Unit I.

2.3.7 Borrowing and Use of Forest Areas Permit Legislation

The construction of the UCPS hydropower plant is in a forest area. Therefore, PLN is required to have a land use permit based on the Ministry of Forestry Regulation Number: P.16/Menhut-II/2014 concerning Guidelines for Borrowing and Using Forest Areas. PT PLN (Persero) will act according to the Decree by the Head of the Investment Coordinating Board, No.63/I/IPPKH /PMDN/ 016, concerning the borrowing and use of 409 hectares of forest area for the construction of the UCPS hydropower plant in Limited Production Forest Areas and Permanent Production in the Regencies of West Bandung and Cianjur, West Java.

The current status of forest lease-to-use (PPKH) with a land area of 155.89 hectares (ha) can be used because it has obtained principle permits and dispensation permits, which are currently in the process of fulfilling the requirements for issuing borrow-to-use permits. Meanwhile, the Land Borrowing and Use of Forest Area (PPKH) compensation area of 161.5623 Ha, of the total 311.78 Ha (51.82 percent,) has been released. The handover of land for compensation phase I, covering an area of 152.27 ha, is currently in the process of application. Issuance of technical considerations for land compensation candidate phase II from the West Java Provincial Forestry Service (Dishut Prov Jabar) has been completed. The status of forest area swap (TMKH), with a land area of 229.36 ha, has obtained a principle permit and is currently in the process of applying for a dispensation permit.

2.3.8 Legislation concerning Utilization of Water Resources

The construction of the UCPS hydropower plant is a development of electricity procurement from water resources. According to the general explanation contained in the Law of the Republic of Indonesia No.17 of 2019 concerning Water Resources, it is explained that one of the uses of water resources can be made for businesses that use water as a medium or the main element in their operations such as hydroelectric power.

The construction of the UCPS hydropower plant is a development of electricity procurement from water resources. According to the general explanation contained in the Law of the Republic of Indonesia No.17 of 2019 concerning Water Resources, it is explained that one of the uses of water resources can be made for businesses that use water as a medium or the main element in their operations such as hydroelectric power.

The construction of the UCPS hydropower plant, which uses water resources as the main medium, has the potential to provide a source of energy as defined in Article 1 number 16 Law of the Republic of Indonesia No.17 of 2019 concerning Water Resources. The development of the Cisokan Pumped Storage Hydroelectric Power Plant, aims to harness this potential energy and provide benefits to human livelihoods. In utilizing this potential, PLN is obliged to follow the regulations related to management of water resources (Chapter 5) and Permitting on use of Water Resources (Chapter 6) of Law Number 17 of 2019 concerning Water Resources.

Regarding the requirement for developing a water resources management plan, which includes conservation, utilization and control of the potential water energy, PLN is obliged to follow the requirements contained in Law of the Republic of Indonesia No.17 of 2019 concerning Water Resources for development of the UCPS hydropower plant.

In 2014, the Ministry of PUPR issued Ministerial Decree No. 619 / KPTS / M / 2014 concerning the granting of water resources utilization permits (SIPA) from the Cisokan River to PT. PLN (Persero). The permit conditions state the following:

1. The maximum abstraction of water for filling the reservoirs from the Cisokan River is 6.21m^3/s during four months of we season, measured at one measuring point using a volumetric measuring device.
2. To ensure there is enough water for maintaining river ecological function, the Q95 of the reliable water flow (0.55m^3/s) should be released at all times. (*This is a minimum flow).*
3. In the dry season, if flow in the Cisokan River is less than 0.55m^3/s, then PLN should release a minimum flow of 0.55m^3/s for river ecosystem maintenance, by taking additional compensation water from the reservoir.
4. In extreme climate conditions, the bottom outlet should be opened to fulfill additional irrigation water downstream, in accordance with the lowest realized irrigation water take requirements during the past 13 years which is 0.01m^3/s as the result of water balance during extreme climate year.

2.3.9 Legislation concerning Extra High Voltage Transmission Lines

To distribute the electricity generated by the UCPS hydropower plant, a connection to the Java-Bali transmission network is required. The proposed connection is a 500kV Extra High Voltage Transmission Line. The network will comprise of two transmission lines, built to the north of UCPS, which will be connected to the Cibinong-Saguling transmission line. The length of the transmission lines will be 15.5 km and 15.9 km respectively, with 82 towers with a minimum tower height of 30.5 m.

During the construction of the transmission lines, PT PLN (Persero), the Central Java Development Main Unit 1, must follow the Ministry of Energy and Mineral Resources RI Regulation No.2 of 2019 concerning Amendments to the Ministry of Energy and Mineral

Resources Regulation No. High Voltage Transmission of Delivery for the Distribution of Electric Power.

2.3.10 Endangered Wildlife and Biological Resources Protection

The following list of Indonesian environmental regulations specifically pertains to flora and fauna. A full list of environmental regulations is presented in the ESMP.

- Indonesian Act Number 5, 1990 about Conservation of Natural Resources and Ecosystems.
- Indonesian Act Number 32, 2009 about Protection and Environmental Management.
- Indonesian Act Number 27, 1999 about Environmental Impact Assessment.
- Indonesian Act Number 13, 1999 about Animal Poaching
- Indonesian Act Number 7, 1999 about Preservation of Fauna and Flora.
- Indonesian Act Number 8, 1999 about Utilization of Plants and Wildlife.
- Presidential Regulation Number 23, 1990 About Environmental Impact Management Agency
- President Regulation Number 4, 1993 about National Flora and Fauna.
- West Java Provincial Regulation 2/2006 about management of protected areas

The Indonesian Act no. 5 of 1990 is of direct relevance to biodiversity conservation in the UCPS area concerning legally protected species. Article 21 of the Act states that:

I. Each person is forbidden to:

a) take, cut, possess; damage; destroy; take care of; or trade protected flora or its parts, alive or dead
b) export protected flora or its parts, alive or dead from any places in Indonesia

2. Each person is forbidden to:

a) catch, wound, kill, store, possess, and trade protected fauna alive
b) store, possess, care of, and trade dead protected fauna
c) export protected fauna from any places in Indonesia
d) trade, store or possess skin, body or any other part of protected fauna or things made from part of fauna
e) take, damage, destroy, trade, store or possess eggs and/or nests of protected fauna

Act Number 7 of 1999 clarifies which species are protected, with the fauna and flora sections above indicating which species are concerned in Cisokan.

2.3.13 Legislations for the Protection of Children, Women and People with Disabilities

During construction of the UCPS hydropower plant, PLN must address the rights of the community, especially women, children and people with disabilities. PLN is obliged to pay attention to and comply with existing laws and regulations as a form of prevention of impacts that may disproportionately impact women, children and people with disabilities, both at the central and regional levels. The laws and regulations that must be adhered to are as follows:

a. Law Number 23 of 2003 concerning Child Protection;

b. Law Number 35 of 2014 concerning Amendments to Law Number 23 of 2002 concerning Child Protection;
c. Law Number 8 of 2016 concerning Persons with Disabilities;
d. Government Regulation Number 65 of 2015 concerning Guidelines for Diversion Implementation and Handling of Children Not Aged 12 Years Old;
e. Regent Regulation Number 84 of 2018 concerning Amendments to Perbup No. 2 of 2018 concerning the Establishment of the UPTD in the Cianjur Regency Government Its existence is based on the work area in the nearest sub-district;
f. Cianjur Regency Regional Regulation Number 6 of 2015 concerning Implementation of Child Protection;
g. Cianjur Regency Regional Regulation No. 3 of 2010 concerning the Eradication of Trafficking in Persons;
h. Cianjur Regency Regional Regulation Number 1 of 2020 concerning the Prevention and Handling of Deviant Sexual Behaviors;
i. Cianjur Regent Regulation Number 84 of 2019 concerning Duties, Functions and Work Procedures of Regional Technical Implementing Units in the Field of Population Control, Women Empowerment and Child Protection at the Office of Population Control, Family Planning, Women's Empowerment and Child Protection in Cianjur Regency.

2.3.11 Gender and Gender Based Violence

The World Bank Group's Gender Strategy (FY16-23), and companion EEX (Energy and Extractives) Gender Note act as guidance frameworks to emphasize four objectives:

a. improving human endowments;
b. removing employment constraints;
c. removing barriers to women's ownership and control over assets; and
d. empowering women's voice and agency.

The WB Gender Strategy aligns well with Indonesia's commitment to gender equality and women's empowerment. More details of the GoI's gender milestones can be found in Table 9.

a. International: Indonesia has ratified the UN Convention on the Elimination of All Forms of Discrimination against Women (CEDAW) (1979) and is committed to the Beijing Declaration and Platform for Action (1995), both of which provide guidance on eliminating obstacles for women to fully participate in social, economic and political life. Indonesia has issued a Presidential Decree (no 57/2017) as the legal basis for the implementation of the Sustainable Development Goals (SDGs), which includes a specific goal on gender equality and women's empowerment (SDG number 5). Indonesia's global commitments to UN Women include a focus on increasing the participation and representation of women in decision-making processes, reducing maternal mortality by improving access to reproductive health services, and eliminating all forms of violence against women. In 2015, Indonesia committed to the G20 Development Commitments, which included a pledge to reduce the gender gap in labor force participation by 25 percent by 2025.
b. National Level: Indonesia has adopted a policy and institutional framework that promotes women's rights. The Indonesian Constitution gives equal rights to men and women and several national laws and regulations support this. Indonesia was one of the first countries in the South East Asian region to establish a separate

Ministry for the Role of Women. The Government has also passed several laws and regulations to protect women and children from violence, increase the number of women in politics, and promote gender mainstreaming in planning and budgeting, which is central to the Government's gender equality efforts. More recently, the Indonesian Government committed to improving gender equality in RPJMN 2020-2024, which includes targets on access to education, employment, health, and representation in politics. However, the implementation of these laws and targets is often hindered by several factors, such as limited institutional capacity and the lack of clear mandate and implementation strategies. The Government of Indonesia does not currently have any overarching strategies on improving gender equality, although targets related to gender are included in the Medium-Term Development Plan, 2020-2025.

c. Local government level: relevant laws include West Java Provincial Regulation Number 5 of 2006 concerning Child Protection; West Java Provincial Regulation Number 3 of 2008 concerning the Prevention and Management of Victims of Trafficking in Persons; and Governor Regulation Number 3 of 2014 concerning the implementation of the minimum service standard (SPM) in integrated services for victims of trafficking in persons and violence against women and children. For government policies at the district/ city level, namely Cianjur Regency and KBB, as the local government for the location of the UPCS Hydropower construction, no policy specifically addresses violence mitigation against women and children. However, policies that support efforts to prevent acts of violence against women and children or GBVs are already in place, including Cianjur Regency Regulation No. 3 of 2010 concerning Combating Trafficking in Persons; Cianjur Regency Regional Regulation No. 6 of 2015 concerning Implementation of Child Protection; Cianjur Regency Regulation No. 84 of 2019 concerning the Duties, Functions and Work Procedures of Regional Technical Implementation Units for Population Control, Women Empowerment and Child Protection in the Office of Population Control, Family Planning, Women's Empowerment and Child Protection in Cianjur Regency. The new KBB has West Bandung Regency Regulation No. 1 of 2016 concerning the Integrated Service Center for the Empowerment of Women and Children (P2TP2A) of West Bandung Regency.

Table 9. Key Gender Milestones by Government of Indonesia

Year	Government Key Gender Milestones
2000	Gender mainstreaming President Abdurrahman Wahid issued Presidential Instruction No. 9 of 2000 on Gender Mainstreaming in National Development ("Inpres No. 9/2000") that instructs all government agencies, at national, sub-national and local levels, to mainstream gender in all policies and programs throughout its planning, implementation, monitoring and evaluation.
2008	Guidelines for gender mainstreaming The Minister of Home Affairs Regulation No. 15 of 2008, which later changed to The Minister of Home Affairs Regulation No. 67 of 2011, concerning Gender Mainstreaming in the Region, provides guidelines for sub-national and local governments concerning integrating gender in their policy strategy and development programs. This regulation shows commitment of the national government to mainstreaming gender at local levels. At the same time, it provides opportunities for optimum participation of all stakeholders in development programs. This regulation also mandates all local governments to develop an Action Plan on Gender Mainstreaming at Local or Regional levels (Rencana Aksi Daerah Pengarusutamaan Gender).
2008	Gender safeguarding The Minister Women Empowerment and Child Protection Regulation No. 2 of 2008, concerning Guideline of the Implementation of Women's Protection, encourages the integration of gender

	safeguarding into all activities of government agencies, NGOs/CSOs and universities, including planning, implementation, monitoring and evaluation, reporting, budgeting, mentoring and supervision. The strategy of implementation of gender safeguarding is through Gender Focal Point or Pengarusutamaan Gender ("PUG").
2009	Disaggregated data The Minister Women Empowerment and Child Protection Regulation No. 6 of 2009, concerning Disaggregated Data by Gender and Age, should be collected, analysed and used as part of the strategy to integrate gender in planning, budgeting, implementation, monitoring and evaluation of policy and development program.
2012	Gender responsive planning and budgeting Four ministers signed a Circular Letter about National Strategy to Accelerate Gender Mainstreaming through Gender Responsive Planning and Budgeting. The four ministers included National Development Planning Agency ("Bappenas"), Ministry of Finance ("MoF"), Ministry of Home Affairs ("MoHA") and MoWECP. The national strategy encouraged national, sub-national and local governments to implement Gender Responsive Planning and Budgeting ("GRPB"). The GRPB also needs to align with the national development plan to support good governance practice and sustainable development as per the SDGs.

2.3.12 Legislation Related to Corporate Social Responsibility

The Cisokan hydropower project has implications for the surrounding environment. The surrounding environment expects social and environmental responsibility from PT PLN (Persero) Central Java Development Main Unit 1. Article 74 of Law No.40 of 2007, concerning Limited Liability Companies, regulates the obligation to carry out corporate social and environmental responsibility for a limited liability company whose business activities are managing natural resources and companies whose business activities are related to natural resources. This obligation is the company's commitment to participate in sustainable economic development in order to improve the quality of life and the environment that is beneficial, both for the company itself, the local community, and society in general.

2.4 International Commitments

International provisions relating to Labor and Working Conditions are as follows:

1. ILO fundamental conventions which have been ratified by the Government of Indonesia as follows:

   a. Freedom of Association and Protection of the Rights to organize Convention, 1948 (No.87)
   b. Right to Organize and Collective Bargaining Convention, 1949 (No.98)
   c. Forced Labour Convention, 1930 (No.29)
   d. Abolition of Forced Labour Convention, 1957 (No.105)
   e. Minimum Age Convention, 1973 (No.138)
   f. Worst Forms of Child Labour Convention, 1999 (No.182)
   g. Equal Remuneration Convention, 1952 (No.100)
   h. Discrimination (Employment and Occupation) Convention, 1958 (No.111)

2. The Convention on The Elimination of All Forms of Discrimination Against Women was ratified through Law Number 7 of 1984 concerning Ratification of the Convention on the Elimination of All Forms of Discrimination Against Women

3. Article 7, International Covenant on Economic Social and Cultural Rights, explains that States Party to this Covenant recognize the right of everyone to enjoy just and favorable working conditions, and in particular guarantee:

a. the pay that gives all workers, at the minimum:
    1. fair wages and remuneration that corresponds to work that is equal without discrimination of any kind, especially for women who must be guaranteed working conditions that are not lower than those enjoyed by men with the same wages for the same work;
    2. a decent life for themselves and their families, in accordance with the provisions of this Covenant;
b. safe and healthy working conditions;
c. equal opportunities for everyone to be promoted to a higher level, without being based on any considerations other than seniority and ability;
d. rest, reasonable working hours, and periodic holidays with pay or other benefits on public holidays.

United Nation Framework Convention on Climate Change, which has been ratified through Law Number 6 of 1994 concerning Ratification of the United Nations Framework Convention on Climate Change and the Kyoto Protocol to The United Nations Frameworks Convention on Climate Change which Indonesia, has ratified through Law Number 17 of 2004 concerning Ratification of the Kyoto Protocol to The United Nations Framework Convention on Climate Change (Kyoto Protocol to the United Nations Framework Convention on Climate Change).

In 2015, the 21st Session of The Conference of the Parties to the United Nations Framework Convention on Climate Change/ COP 21 UNFCCC was held in Paris. This conference successfully adopted the Paris Agreement to the United Nations Framework Convention on Climate Change. This Paris Agreement contains provisions regarding a nationally determined contribution (NDC) which is expected to be implemented in 2020.

Indonesia, through the President of the Republic of Indonesia, Joko Widodo, stated that the Paris Agreement must reflect balance, justice and be in accordance with national priorities and capabilities so that it needs to be binding, long-term and ambitious but not hinder the development of developing countries like Indonesia. For this reason, Indonesia is committed to reducing emissions by 29% under any effort or business as usual (BAU) by 2030 which can be increased to 41% with international cooperation.

Based on this statement, Indonesia has drafted a Draft Law on Ratification of the Paris Agreement to The United Nations Framework Convention on Climate Change.

International provisions related to Community Health and Safety are as follows:

a. Protocol of 2002 to the Occupational Safety and Health Convention, 1981

b. Labor Standards Number 155, Occupational Safety and Health Convention, 1981, ratified through Presidential Regulation Number 34 of 2014 concerning Ratification of Convention Concerning the Promotional Framework for Occupational Safety and Health/Convention 187, 2006.

c. Article 12 of the International Covenant on Economic Social and Cultural Rights was ratified through Law Number 11 of 2005 concerning Ratification of the International Covenant on Economic Social and Cultural Rights which explains that:

1. The State Parties to the present Covenant recognize the right of everyone to the enjoyment of the highest attainable standard of physical and mental health

2. The steps which the State Parties to the present Covenant will take to achieve the full realization of this right shall include those necessary to bring about:

(a) provisions for the reduction of the stillbirth and mortality rates of children and the healthy development of children;

(b) improvement of all aspects of environmental and industrial health;

(c) prevention, treatment and control of all infectious, endemic and other occupational diseases;

(d) the creation of conditions which will warrant all medical care and attention in the event of a person's illness;

Land acquisition for inundation, access roads, and transmission sites must abide by international provisions related to Land Acquisition, Restriction on Land Use and Involuntary Resettlement, one of which is Article 11 paragraph 1, the International Covenant on Economic Social and Cultural Rights is ratified by law Number 11 of 2005, concerning Ratification of the International Covenant on Economic Social and Cultural Rights. The law highlights that States Party to this Covenant recognize the right of everyone to an adequate standard of living for him and his family, including food, clothing and housing, and for the continuous improvement of living conditions. Party States will take appropriate steps to ensure the realization of this right, recognizing the importance of international cooperation based on voluntary agreements.

Indonesia has ratified the International Provisions related to the Convention on Biological Diversity with Law Number 5 of 1994, concerning the Ratification of the United Nations Convention on Biological Diversity and the ratification of the Biosafety Convention with Law Number 21 of 2004 concerning Ratification of the Cartagena Protocol on Biosafety to The Convention on Biological Diversity (Biological Security of the Convention on Biodiversity).

Indonesia is also signatory to the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP).

The International Covenant on Economic, Social and Cultural Rights was ratified through Law Number 11 of 2005 concerning Ratification of the International Covenant on Economic Social and Cultural Rights.

International provisions related to Cultural Heritage are as follows:

Article 15 of the International Covenant on Economic Social and Cultural Rights was ratified through Law Number 11 of 2005 concerning Ratification of the International Covenant on Economic Social and Cultural Rights which explains that:

1. The States party to the present Covenant recognize the right of everyone:

a. to participate in cultural life;

b. to enjoy the benefits of scientific progress and its application;

c. to benefit from the protection of moral and material interests arising from the scientific, literary or artistic works which they have created.

2. The steps which States party to the present Covenant shall take to achieve the full realization of this right shall also include the steps necessary to preserve, develop and disseminate science and culture.

3. The States party to the present Covenant are committed to respect the freedom necessary for scientific research and creative activity.

4. The States party to the present Covenant recognize the benefits to be reaped from the promotion and development of international relations and cooperation in the field of science and culture.

CHAPTER 3. WORLD BANK ENVIRONMENTAL AND SOCIAL FRAMEWORK (ESF)

3.1 ESS-1 Assessment and Management of Environmental and Social Risks and Impact

Environmental and Social Standards 1 explains the responsibilities related to the assessment, management, monitoring of environmental and social risks, and impacts associated with each project supported by the World Bank through Investment Project Financing (IPF. The aim of which is to achieve consistent environmental and social results, in line with Environmental and Social Standards (ESS).

3.2 ESS-2 Labor and Working Conditions

Environmental and Social Standards 2, outlines the procedure of supporting good relations between workers and management. For example, the absence of discrimination and equal opportunities in project provision; protection or restrictions on elderly workers, female workers, those with disabilities, children (working age that must comply with ESS standards), migrant workers, and contract workers; a labor grievance mechanism and other issues related to wages and working conditions.

The Social and Community Management Plan, the ESMP and the C-ESMP contain the control measures for labor and working condition risks. The project has developed a Labor Management Procedure (LMP) as part of the Social and Community Management Plan which sets out the Project's approach to meeting national requirements as well as the World Bank's Environmental and Social Framework, particularly ESS 2 on Labor and Working Conditions and ESS 4 on Community Health and Safety.

3.3 ESS-3 Resource Efficiency and Pollution Prevention and Management

Environmental and Social Standards 3 describes the requirements for dealing with efficiency of resource use, as well as the prevention and management of pollution throughout the project. This relates to water use during operation, construction materials use, construction erosion and sediment control, hazardous substances and waste management, construction emissions into air and net greenhouse gas emissions from the project (construction and operation).

3.4 ESS-4 Community Health and Safety

Environmental and Social Standards 4 describes the standardization of health, safety and security for the people affected by the project and the responsibilities of the project owners in order to mitigate the risks or impacts that occur during the project, especially for vulnerable communities. The risk-management strategy for the project includes the SCMP, which includes protection from worker-related risks (GBV, diseases) and GBV Action Plan. COVID-19 protocols are required in accordance with ESS4. PLN has prepared a Construction Supervision and Quality Assurance Plan, an Instrument Plan, a preliminary Operational and Maintenance Plan and a Broad Framework for Emergency Preparedness. These will be further developed during project implementation. PLN will prepare a Reservoir Filling Plan prior to inundation. The Contractor is required to prepare and implement a Health, Safety, and Security Management Plan to manage occupational and community health and safety under their responsibility.

3.5 ESS-5 Land Acquisition, Restrictions to Land Use and Involuntary Resettlement

Environmental and Social Standard 5 describes what must be carried out in relation to land acquisition, restrictions on land use and resettlement. The requirements are including eligibility classification, project design, compensation and benefits for affected persons, community engagement (incl. ensure that women's perspectives are obtained, and their interests factored into all aspects of resettlement planning and implementation), grievance mechanism, planning and implementation, physical-economical displacement, collaboration with other responsible agencies or subnational jurisdictions, and technical and financial assistance.ESS-6 Biodiversity Conservation and Sustainable Management of Living Natural Resources

Environmental and Social Standards 6 describes the standardization of the protection and preservation of biodiversity and the sustainable management of living natural resources. Protecting and conserving biodiversity, as well as managing living natural resources are fundamental to sustainable development and recognize the importance of maintaining the ecological functions that are at the core of habitats, including forests, and the biodiversity they support. The Biodiversity Management Plan provides a detailed program of activities to achieve net gain of biodiversity values, as per the requirements of ESS6.

Environmental and Social Standards 6 also describes the management of primary production areas and the sustainable harvesting of living natural resources, recognizing the need to consider the livelihoods of project affected parties, including indigenous people. The Forest Partnership Framework allows for the use of forest resources while protecting the biodiversity values.

3.6 ESS-7: Indigenous Peoples, Historically Underserved, Traditional Local Communities

ESS7 ensures that the development process fosters full respect for the human rights, aspirations, identity, culture, and natural resource-based livelihoods of Indigenous Peoples, Historically Underserved Traditional Local Communities. ESS7 also highlights avoiding adverse impacts of projects on these populations or, when avoidance is not possible, minimizing, mitigating and/or compensating for such impacts. This ESS applies to distinct social and cultural groups identified in paragraphs 8 and 9 of the ESS.

ESS7 was not triggered for the project. There are no indigenous people living in the project area based on the detailed census conducted. Most of the people in the project area are Sundanese, the dominant ethnic group in West Java, who speak the national language. The investigations carried out as part of the Environmental Assessment did not identify cultural, social or political institutions that are separate from those of the dominant society and culture.

3.7 ESS-8 Cultural Heritage

Environmental and Social Standards 8 describes the steps that must be taken in order to protect cultural heritage that may be affected during the project. The UCPS project has a Cultural Heritage Management Plan, presented in the ESMP, that identifies both tangible and intangible cultural heritage to be protected, protocols for removing cultural heritage items that cannot be protected, and procedures for sites / artifacts / remains that are found by chance during construction.

3.7 ESS-10 Stakeholder Engagement and Information Disclosure

Environmental and Social Standards 10 explains the importance of open and transparent engagement between stakeholders and PLN as project stakeholders. Information disclosure is an essential element of good practice. Effective stakeholder engagement can enhance the environmental and social sustainability of a project, increase project acceptance, and make a significant contribution to successful project design and implementation.

3.8 Gap analysis of Indonesian laws and regulations verses ESS

An assessment of Indonesian laws and regulations and the World Bank Environmental and Social Standards indicates gaps and the gap filling measures undertaken (Table 10).

Table 10. Assessment of the relevant laws and regulations in Indonesia against the requirements of the World Bank's Environmental and Social Standards (ESSs)

ESS Topics	Gap Analysis	Gap Filling Measures undertaken
ESS1 Assessment and Management of Environmental and Social Risks and Impacts. **Generally, the relevant laws and regulations in Indonesia on the environmental and social risks and impacts assessment are aligned with the World Bank's ESSs. Identified gaps should be addressed directly in the project-level planning and implementation processes.**		
Environmental and Social Assessment	Under the GoI regulation, the AMDAL, UKL-UPL and/or SPPL is based on threshold values while the Bank requirements are based on magnitude of impacts. The AMDAL/UKL-UPL do not usually or do not assess in detail: cumulative impacts, associated facilities, critical habitats and project alternatives.	ESIA for the UCPS follows the World Bank ESS1 requirements which contributes to complementing the AMDAL for the project.
Reference to legal and administrative framework such as international environmental treaties, agreements, standard policies etc.	The AMDAL, UKL-UPL and/or SPPL usually provides limited references to legal and administrative framework such as international environmental treaties, agreement, international standard policies etc. (e.g., the current regulation only refers to "other data and information").	International treaties covered under UCPS ESIA.
Project Area of Influence	Under the GoI regulation, the AMDAL, UKL-UPL and/or SPPL is not required or limited to assessing associated facilities, ancillary facilities, induced impacts and site selection analysis.	Project area of influence applies to ESS1 requirements and covered under UCPS ESIA.
Environmental and Social Management and Monitoring Plan (ESMP) implementation	The RKL-RPL or UKL-UPL usually has limited arrangement for handling of grievances, costs estimate for implementation of the environmental and social management plan	Grievance mechanism is outlined under UCPS SCMP while budget schedule and capacity building is addressed under UCPS ESMP.

Capacity Development and Training provisions under the ESMP document	The RKL-RPL or UKL-UPL usually has limited arrangement for capacity development and training for implementing the environmental and social management plan, for which the contractors may have limited understanding on the requirements for implementing the environmental and social management plan	Covered under UCPS ESMP that includes a TOR for Contractor ESMP.
ESS2 Labor and Working Conditions. **Indonesia has ratified all core conventions of ILO labor and working conditions. No major gaps are identified between Indonesian laws and regulations with the requirements of the ESS2.**		
Grievance mechanism	The national regulations provide avenues to resolve work-related issues. However, workers may not feel comfortable resolving such issues through deliberation and agreement and taking cases further to legal mechanism may even discourage them to submit their concerns.	Labor management and grievance mechanism covered under UCPS SCMP and TOR for Contractor ESMP covered under the UCPS ESMP.
Occupational Health and Safety	The assessment and mitigation of occupational health and safety is not covered by the AMDAL process and is treated separately under labor laws.	Assessment of occupational health and safety risks and mitigation measures covered under the UCPS ESIA and ESMP, including TOR for Contractor ESMP.
ESS3 Resource Efficiency and Pollution Prevention and Management. **The Government's environmental laws and regulations on pollution prevention and management are comprehensive, covering airshed management and emissions standards, management of hazardous and non-hazardous wastes, and water quality effluent discharge standards. These regulations consider ambient conditions, and through the engineering designs and ESIA, pollution prevention measures are sought and built into the project. Key gap is on estimating Greenhouse Gas (GHG) emissions.**		
Estimation of GHG emissions	Requirements for estimating GHG emissions for hydropower projects not specifically covered by Indonesian legislation system.	Estimation of GHG emissions will be prepared for the UCPS.
ESS4 Community and Health Safety **Potential risks and impacts, as well as the mitigation measures to the community health and safety, are assessed in the AMDAL process and covered in the environmental documents (AMDAL/UKL-UPL/SPPL). No major gaps are identified in the relevant laws and regulations.**		
Infrastructure and equipment design and safety	There is no clear requirement under national regulations to involve independent expert(s) to review high-risks structural designs, construction, operation, and decommissioning.	UCPS will engage independent panel expert(s) as appropriate to review the proposed technical designs as early as possible, monitor the project during and upon completion of construction, prior to and after commissioning.
Security personnel	Involvement of security personnel is arranged only for national vital objects.	Reservoir security and management of community safety is covered under the UCPS ESIA and ESMP (TOR for Contractor ESMP)
Community exposure to health issues	No major gaps are identified.	Community health risks are covered under the UCPS ESIA and ESMP.
ESS 5 Land Acquisition, Restrictions on Land Use and Involuntary Settlement.		

Applicable laws and regulations in Indonesia have covered the main topics of the ESS5. However, some gaps are identified in terms of compensations for squatters, livelihoods restoration and indirect impacts related to land acquisition.		
Sustainable development program	Different modes of compensation other than cash, particularly relocation and land-for-land, are not sufficiently elaborated, particularly on aspects related to livelihoods restoration measures.	Livelihood restoration and sustainable development are covered under the UCPS LARAP and SCMP.
Direct and indirect impacts	Adverse social and economic impacts due to restrictions of access and land use are not explicitly covered under the Law 2/2012.	Potential for access restriction is covered under UCPS ESIA and FPF.
Associated facilities and legacy issues	Not covered.	Legacy issues of associated facilities which were acquired under Indonesian law will be assessed against the provision of ESS5.
Replacement costs	No gaps. The Independent appraisal team determines compensation for loss of physical and non-physical assets and premium/solatium (for emotional attachment) at replacement costs.	Replacement cost covered under the UCPS LARAP.
Livelihoods restoration	Law No. 2/2012 and its implementing regulations do not elaborate on the options and implementation of assistance and livelihood restoration.	Livelihood restoration and sustainable development are covered under the UCPS LARAP and SCMP.
Assistance to physically displaced households	Assistance to displaced households due to land acquisition are not covered by Law No. 2/2012 and its implementation regulations (Perpres No. 71/2012).	Assistance to physically displaced parties covered under the UCPS LARAP.
Compensation for loss of income sources or means of livelihood	Legal provisions are deficient to recognize entitlements for loss of incomes and means of livelihood due to land acquisition.	Compensation for loss of income sources covered under UCPS LARAP.
Support for affected persons who have no recognizable legal right or claim to the land they are occupying	Perpres No. 62/2018 requires provision of compensation and assistance for those who do not own the land but have occupied or utilized the land with a set of criteria.	Eligibility criteria and entitlement for each category of project-affected persons (PAPs) is covered under UCPS LARAP.
Land for land	Law 2/2012 and Implementation Regulations (Perpres 71/2012) do not provide details on the procedures for replacement land. Further, the provision in Para 5, Article 77, and Para 4 of Article 78 (Perpres 71/2012) are in contradiction of Bank's Policy 4.12 that requires completion of relocation arrangements before affected households are displaced.	Provisions covered under UCPS LARAP.
Compensation options	The provision of replacement land is not sufficiently elaborated.	Compensation options covered under UCPS LARAP.
Forced eviction	Not explicitly covered.	Forced eviction is avoided under UCPS.

	Ownership rights to land and its associated properties will be relinquished upon compensation payments or court decisions.	
Land Acquisition and Resettlement Planning Instruments	The scope of the Land Acquisition Plan does not clearly include identification of vulnerable groups, public consultation and participation, and monitoring and evaluation requirements. Further, the Plan does not include relocation assistance and livelihood restoration, where necessary. The Land Acquisition Plan does not fully cover elements and details of those in the LARAP. Timing of the preparation of the Land Acquisition Plan with results of inventory of affected land plots should be advanced to the planning stage.	Resettlement arrangements covered under UCPS LARAP.
Costing	Although the Law No. 2/2012 requires land acquisition plans to include estimated costs for land acquisition and/or resettlement, it does not include the costs for providing assistance and livelihood restorations.	Overall land acquisition costs, including livelihoods assistance, established as part of land acquisition planning will be financed by PT. PLN.
Disclosure and engagement	Law No. 2/2012 and implementation regulations require dissemination of information on affected land and other assets, and applicable compensation amounts to affected households. Public announcement of inventory results is required at the ward/village government offices, sub-district offices and at the place where land acquisition is conducted. However, such disclosures are often available at specific venues that may not be accessible to a wider audience.	Disclosure of information and engagement of landowners are covered by UCPS LARAP process. Relevant project documents will be disclosed and continue to be consulted to the public in a suitable form to meet Bank's disclosure requirements. Community engagement will form part of project implementation.
Grievance Mechanism	Provisions of the Law No. 2/2012 and implementation regulations (Perpres 71/2012) have elaborate and time-bound procedures for filing complaints by affected households and processes to address complaints and grievances. However, it does not explicitly require due documentation of grievances.	Grievance mechanism covered under UCPS SCMP.
Monitoring and Evaluation	Law No. 2/2012 does not provide for external monitoring of resettlement implementation and post-implementation evaluation to assess whether the objectives of the resettlement plan have been achieved. Furthermore, it is deficient in providing details on objectives of evaluation.	Monitoring of LARAP implementation is conducted and reported.
ESS 6 Biodiversity Conservation and Sustainable Management of Living Resources. **Government regulations on forestry and biodiversity conservation, in general, support ESS6 for protecting biodiversity. The main gap is that existing regulations do not recognize the requirements for assessing project impacts on natural and critical habitats.**		

Classification, criteria for significant conversion (loss) and degradation of Critical and Natural Habitats	The regulations do not mention specifically about protection of natural and critical habitats as per ESS 6.	Classification, criteria for significant conversion (loss) and degradation of Critical and Natural Habitats covered under UCPS BMP.
ESS 7 Indigenous Peoples/Sub-Saharan African Historically Undeserved Traditional Local Communities. **One key gap between ESS7 and relevant Indonesian laws and regulations is the requirement for the formal recognition of IP communities as an eligibility criterion to be treated as IPs. ESS7 is not triggered by the UCPS.**		
ESS 8 Cultural Heritage. **No major gaps are identified. Government regulation on the protection and preservation of cultural heritage objects is available.**		
Intangible cultural heritage	Preservation of intangible cultural heritage is not specifically regulated in the Indonesian legislation.	Intangible cultural heritage, such as local rituals and at the Cihea irrigation area is assessed under the UCPS ESIA and ESMP.
ESS 10 Stakeholder Engagement and Information Disclosure. **Relevant laws and regulations of Indonesia have covered the requirements of the ESS 10.**		
Engagement with stakeholders; information disclosure; Grievance Redress Mechanism	SEP is not a mandatory document as per GoI regulation.	Arrangements for stakeholder engagement, grievance mechanism and consultations are covered under UCPS SCMP and BMP as part of the UCPS ESMP.

CHAPTER 4. DESCRIPTION OF UCPS HYDROPOWER PLANT

In the UCPS hydropower plant project, the stakeholders are the central and local governments, affected communities and companies, project owners, and project implementers. The involvement of stakeholders with PLN has been transparent for over 10 years. PLN has followed ESS10 to date and will continue to do so under the Social and Community Management Plan, which has equivalence to the Stakeholder Engagement Plan required by ESS10.

4.1 Introduction and Background

The Project is located in the upper basin of the Cisokan River, it is one of the main tributaries of the Citarum River which flows and empties into the Cirata Reservoir, in West Java Province West Bandung and Cianjur Regencies, as shown in Figure 15.

The Cisokan River was identified as a suitable area for Pumped Storage hydropower plant in 1985. A feasibility study was carried out in 1993-1995, followed by an impact and environmental analysis in 1998. The project was, however, discontinued when the Indonesian economy was affected by the wider Asian economic crisis and the level of electricity demand had reduced. In 2007, a detailed design was proposed, an updated environmental impact assessment was submitted to the local government and an environmental ratification of the ANDAL was approved for the UCPS hydropower plant. In 2011, an EIA and SIA study were carried out as a requirement for funding from the World Bank.

Work on the detailed engineering design was undertaken between 1999 and 2002, followed by supplementary design engineering work in 2006 and 2007. From 2012 to 2013, the detailed design was updated and bid documents were subsequently prepared for the main construction works. During the period of detailed design and bid document preparation, prequalification of bidders and the selection of the Contractor for Lot1a and Lot 1b, from 2012 to 2017, PLN retained a panel of experts in roller compacted concrete dam design, rock mechanics, engineering geology, and hydraulic structures. The expert panel reviewed, advised and signed off on key outputs. PLN also retained an additional panel of international and Indonesian social and environmental experts, reviewed and provided advice for the implementation of the ESMP and LARAP.

The construction of UCPS hydropower plant began with the construction of an access road to the main construction project site. From 2012 to 2019, the land acquisition and resettlement process for the new access road and the construction process were carried out. At the same time, land acquisition, resettlement and upgrades to local roads were carried out. Land acquisition and resettlement also occurred from 2012 – 2019 for the dam, reservoir, power station infrastructure and transmission lines.

Since 2011, additional environmental studies and monitoring projects have been conducted. UKL/UPL environmental and social data collection was conducted every semester from 2012-2019, while studies of the Cisokan watershed and monitoring of social programs were completed through an independent monitoring team (IMA) in 2013. Between 2013 and 2015 additional biodiversity studies were carried out for the purpose of identifying biodiversity risks and preparing a biodiversity management plan. An integrated catchment management plan was prepared in parallel. In 2019, a mapping study was conducted in the areas of West Bandung and Cianjur Districts, as well as design reviews and updates on the structure of the Upper and Lower Dam based on hydrological and geological reports on the latest conditions.

The main contractor was selected in 2016, but contract negotiations are continuing due to changing circumstances with project progress. The transmission line contract has not yet been prepared.

This chapter provides details of the design, general layout and key components, details relating to the construction methodology, management and programming, as well as details on how the pumped storage hydropower plant will be operated.

4.2 Location, Accessibility and Layout

The UCPS hydropower plant project is located between 107°11'.00"-107°29'.00" East and 6°55'.00"-7°00'.00" South. The UCPS hydropower plant is located in the Cirata River catchment. The Saguling hydropower plant is in an adjacent watershed to UCPS, while the Cirata hydropower plant is downstream of UCPS. The location of UCPS hydropower plant is spatially presented in Figure 15.

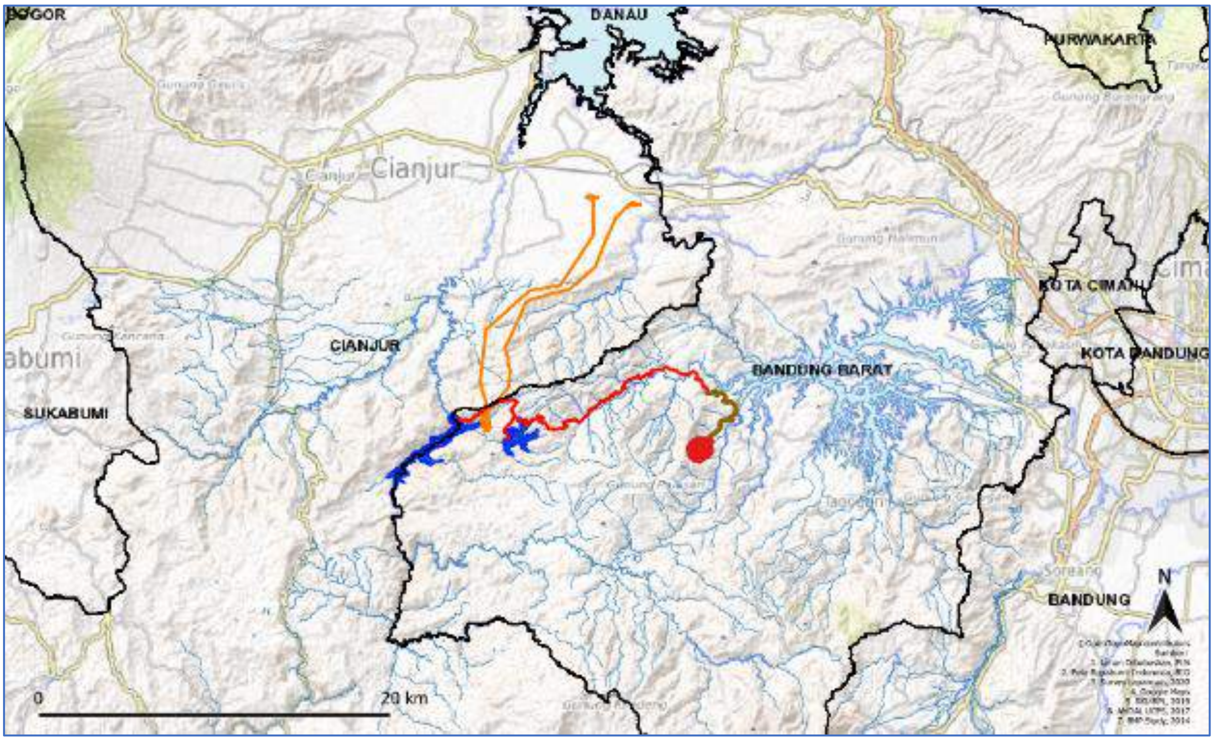


Figure 15. UCPS Project Location, including access road (red), upper and lower dam (dark blue) and transmission lines (orange).

Access to the UCPS Cisokan project site can be reached along two routes, namely:

1. Via Rajamandala

   a. Bandung/ Cianjur-Rajamandala Bandung to the Rajamandala T-junction with a distance of ± 40 Km, while from Cianjur it is 26 km. A national road, 4-wheeled vehicles can pass through the asphalt road.

   b. Rajamandala-Cipari T-junction (Cipari Village), via the Rajamandala-Cipongkor road or the entrance to the Saguling reservoir ± 35 Km, the asphalt road can be passed by 4-wheeled vehicles.

c. Cipari T-junction-via the new access road to the project location ± 20 km.

2. Via Cililin-Cijenuk

a. Bandung-Cipatik via Batu Jajar or via the Soroja toll road exit, via the Margaasih toll gate towards Cipatik Cianjur-Cibeber ± 20 Km, the asphalt road can be passed by 4-wheeled vehicles.

b. Cipatik-Cililin Cibeber-Cibaregbeg ± 10 Km, asphalt roads can be passed by 4-wheeled vehicles.

c. Cililin-Cijenuk-Cipari T junction

d. Cipari T-junction-via the new access road to the project location ± 20 km

The project will include the construction of the upper dam and reservoir, lower reservoir and dam, surge tank, penstock and tailrace tunnels, underground power plants, underground power plants, terminals, access roads, administration buildings and transmission lines. The PLN quarry (Gunung Karang) will be used as a source of rock and base material, while the excavated waste material from the tunnel and power plant will be stored and stabilized in the project area. Other sources of construction materials; iron, cement and fly ash obtained from outside the city are transported to the location. The layout of the construction project construction site is shown in Figure 16.

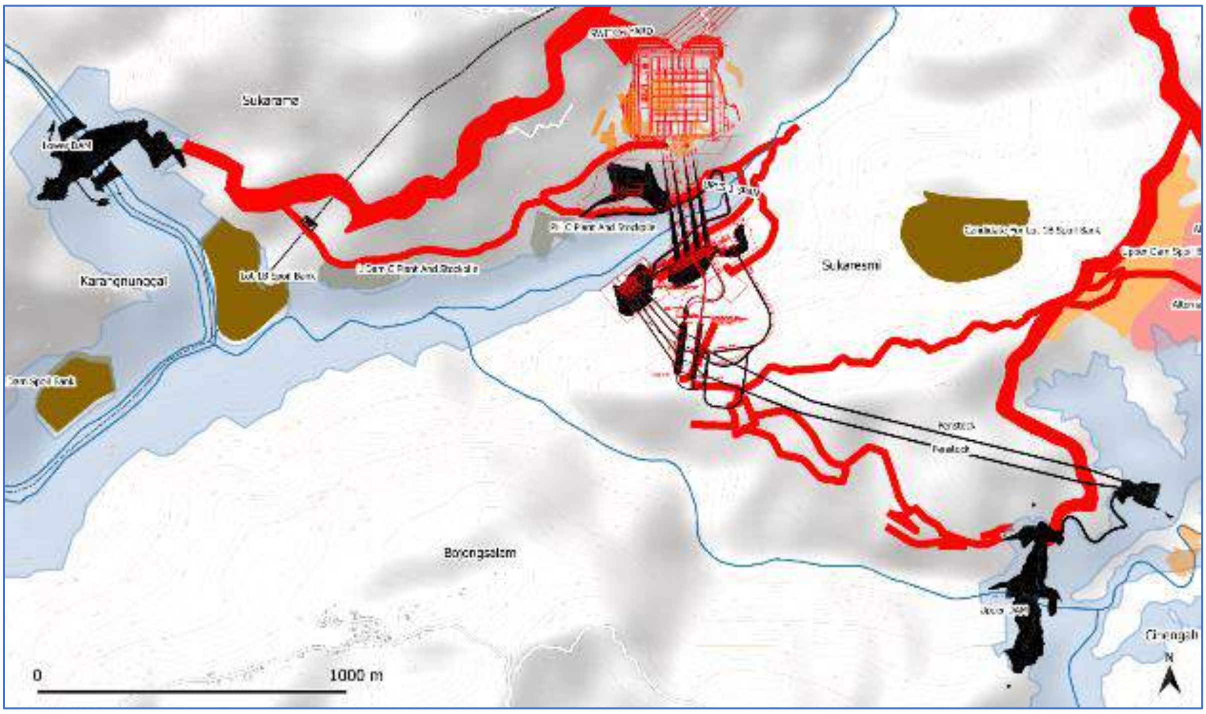


Figure 16 Location of UCPS Hydropower Plant Main Construction

4.3 Design, Size and Capacity

4.3.1 Main Features of Hydropower Plant

The main feature of the Upper Cisokan Hydro Power Plant project is a 75.5 m high dam built on the Cirumamis River, with a watershed of 10.5 km^2 and a reservoir surface area of 80 ha, when water level is at a maximum (see Figure B3, Figure B4, and Figure B8 in Appendix B). The operational fluctuation between the highest and lowest water levels is 19 m. The upper dam body will be constructed from Roller Compacted (RRC) type concrete.

A lower dam will be built on the Cisokan River, with a watershed of 374.0 km^2 and a reservoir surface area of 260 ha at peak water level (see Figure B5, Figure B6, and Figure B8 in Appendix B). The difference in water level during operation between the highest and lowest water levels is 4.5 m. The gravity of the concrete on the lower dam body will be constructed with the Roller Compacted Concrete (RRC) type.

The power plant, with a capacity of 1,040 MW (260 MW x 4 units) and a total pump capacity of 1,100 MW, is placed in an underground power plant. Tunnels will connect the power plant to the reservoir. A substation and administrative office will complement the hydropower plant. The generation duration is 6.5 hours/ day and the pump duration at maximum input is 8.5 hours/day.

Two x 16 km 500 kV transmission lines will connect the UCPS hydropower plant to the Cibinong-Saguling network and the Tasik-Depok network. Some of the main power plant structures are the head race, surge tank, underground power plant, penstock, tailrace tunnel and switchyard, as well as road access and administrative buildings as important supporting structures for the power plant. A PLN-owned andesite hill on Mount Karang, within 30 km of the construction site, will be used as a source of rock, where the chunks of rock will be crushed into gravel and sand as the basic material for making concrete. Waste material excavated from tunnels and power plants will be placed in the disposal area and stabilized in the project area.

During construction, the project will develop a temporary work area, a penstock manufacturing and storage area, a batching plant (concrete processing area), a barracks/ basecamp, and an office building. Infrastructure such as electricity and camp construction, fuel, drinking water and sanitation will be provided.

The main features of the UCPS hydropower plant scheme are listed in Table 11 and the general layout plan of the scheme is shown in Figure 17. The temporary work process during the construction period, including the dumpsite, workers' barracks/basecamp and concrete processing plant location is presented in Figure B7 Appendix B.

Table 11. Main Features of UCPS Hydropower Plant

I. Generating Data	Description	
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 (km²)		10.5	374.0
Surface area of the reservoir when the water is high (km²)		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 (m³)		13,470,000	11,500,000
Total volume (m³)		14,000,000	63,000,000
Average flow of incoming water from the river (m³/sec)		0.4	14.9
Flood design (1/10.000) (m³/sec)		230	1,430
III. Major Civil Construction			
1)	**Dam**	Upper Dam	Lower Dam
	Type	Concrete Gravity (RRC)	Concrete Gravity (RRC)
		75.5	98.0
	Height (m)	375	294
	Dam peak length (m)	800.5	503.0
	Dam peak elevation (m) MASL	369,00	508,000
	Dam Body Volume (m³)		
2)	**Spillway**	Upper dam	Lower dam
	Tipe	Centre overflow	Centre overflow
	Normal Discharge capacity m³/sec)	230	1,220
	Gate Type	No Gate	Radial gates
	Dimensions Height x Width (m)	-	13.5 x 10.0
	Amount	-	2
3)	**Intake**		
	Type	Side Intake	
	Gate	Steel wheeled type gate	
	Amount	2	
4)	**Circular Headrace Tunnel**		
	Length (m)	±1,217 (No. 1), 1,158 (No. 2)	
	Inner diameter (m)	7.4 circular section	
	Amount	2	
5)	**Surge tanks**		
	Type	Restricted orifice type with upper chamber	
	Inner Diameter (m)	15.0	
	Height (m)	78 m(No.1), 81 m(No.2)	
	Amount	2	
6)	**Penstock**		
	Planted *Penstocks* Steel Pipes	Planting steel pipe	
	Length (m)	475 ~ 529 (unit 1 = 475 m, 2 = 485 m, 3 = 517 m, 4 = 529 m	
	Inner Diameter (m)	5.9 ~ 4.17 ~ 3.1	
	Thickness (mm)	20 ~ 52	
	Amount	2 (ID = 5.9 m), 4 (ID = 4.17 ~ 3.1m)	
7)	**Underground Powerhouse**		
	Cave profil type	Bullet shape	
	Height (m)	51.15	
	Max Width (m)	26	
	Length (m)	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	Vertically, one stage Francis Reversible type
	Rated Net Head/ Min Pump Head (m)	276 / 296
	Maximum Turbine Release/ Maximum Pump Release (m3/s)	108 / 90
	Rated Out/ Turbine Shaft Output Max. Pump Input (MW)	269 / 275
	Rated Speed (rpm)	300
	amount	4
2)	**Generator-Motor**	
	Type	Vertical Shaft, 3-Phase AC synchronous
	Rated Generator Output (MVA)	300
	Motor Input (MW)	275
	Rated Voltage (kV)	18
	Rated Power Factor	0.9 lagging
	Rated Frequency (Hz)	50
	Rated Speed (rpm)	300
	Number of Units	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)
4)	**Switchyard**	
	Type Rated Voltage (kV) Number of Feeders	Outdoor (AIS) Breaker and Half (11) 500 8
V. Transmission Line		
1)	to Saguling – Cibinong	
	Voltage Length	500 kV 16 km
2)	to Tasik- Depok Line	

	Voltage Length	500 kV 16 km
VI. Preparatory Work		
1)	**Land Acquisition**	
	Upper Reservoir Lower Reservoir Disposal Area Access Road: a) Existing road (6.7 km) b) New road (27.4 m) Transmission lines (31 km)	105 ha 356 Ha 79 Ha - - 107 ha 105 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 m2
4)	**Distribution Line**	
	Length of lines Voltage	35 km 20 kV

Source: (PLN Enjiniring/Nippon Koei/Newjec Inc./Indokoei International/Wiratman, 2019a)

4.3.2 Upper and Lower Dams and Reservoirs

The dam and reservoir designs and the temporary work areas such as barracks/ basecamp and a number of concrete structures are shown in Figures in Appendix B.

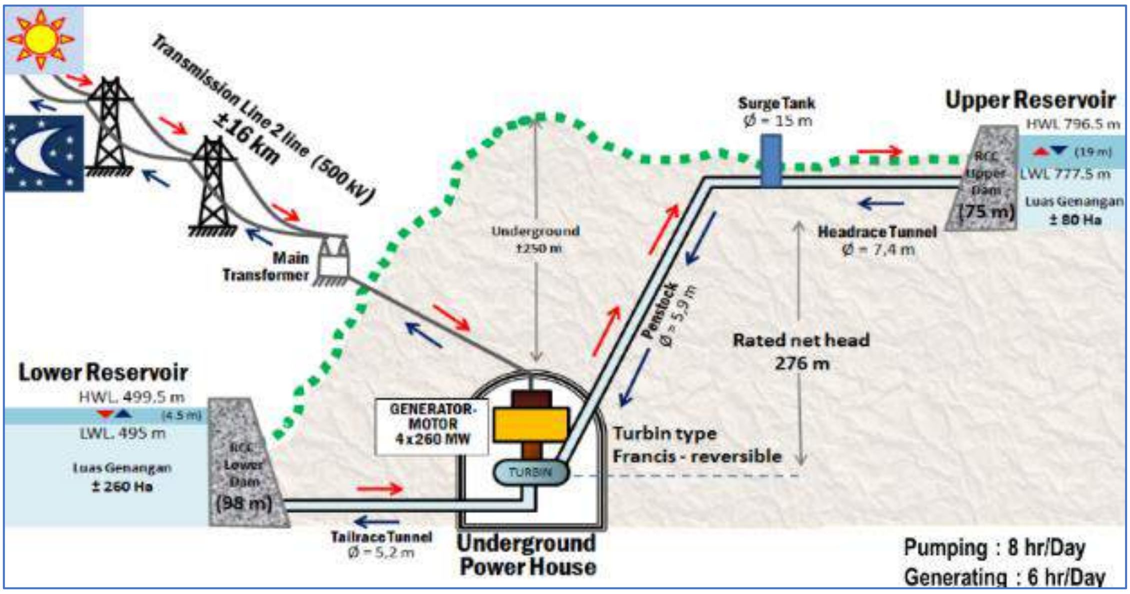


Figure 17. Work System of UCPS Hydropower Plant

The two dams will be constructed using the roller-compacted concrete (RCC) method. The 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 flood event through the spillway, and are designed for a seismic zone rating of 4 for the area. Furthermore, both structures will continue to work and be clean of sediment for 50 years despite erosion of an average of 1.86mm/km^2/year, caused by the water flow into and out of the two outlets.

4.3.2.1 Pre-construction work in rivers

Temporary river diversions will be carried out at each dam area to divert the flow around the work area. When the dam has been built, and before water storage begins, the diversion of the river will be stopped.

Pre-construction work on the upper dam will include diversion of the river to install the new dam, as well as excavating cliffs and riverbanks prior to laying the foundation and constructing the RCC structure. An open chute and box culvert (above ground) will be constructed to carry diverted water around the construction area and back downstream. Rock drills, bulldozers and excavators will be used to excavate dry river and riverbank material.

The pre-construction work on the lower dam will require more preparation due to the size of the river and the persisting landslides at the dam site. On the riverbanks there are deep deposits (more than 15m) of sand and large rocks. The material had piled up from the riverbed and acted as a dam. Storage of this material is expected to cause difficulties during excavation to create the temporary weir (Coffer dam) and the dam itself. For this reason, the designers recommend demolishing large boulders prior to dam installation.

Due to the soft material on the riverbank and the amount of potential flow in the Cisokan River, the engineers designed the initial temporary dam (Coffer dam) with excavated materials to protect the main dam construction area. A diversion tunnel will be constructed to divert the river downstream during the lower dam construction. The tunnels will be drilled, not demolished, and concrete-lined. The river diversion channel in the lower dam will divert water from above the upstream coffer dam to below the lower dam construction area (PLN Enjiniring/Nippon Koei/Newjec Inc./Indokoei International/Wiratman, 2019a).

4.3.2.2 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 continuously shed and compacted to minimize cooling at the joints. The RCC mixture will be transported to the dam from the concrete plant by large trucks. Placement of RCC concrete can still be done during rain with an intensity of <5 mm/day.

Concrete manufacturing activity with a capacity of 120 m^3/day, with a storage warehouse that can accommodate a load of 1,600 tons, is 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 a working day, so that the warehouse has five days' worth of storage time. The power plant will be powered by a diesel generator.

Concrete production of 60m^3/day is planned to meet the usual concrete mix that will be used for other activities. A cement storage building with a capacity of 500 tons will be required. A concrete mixer truck with a capacity of 6 m^3 will carry the mortar to the site. Pre-construction works of reservoir areas and rivers.

Before being flooded, the reservoir area must be stabilized, and cleared of vegetation and potential sources of pollution.

Clearing vegetation is done by cutting down trees and other plants using a chain-saws and other heavy equipment. The communities will still have access to this cleared agricultural products; remaining material will be buried and stabilized outside the flooded area.

Sources that cause water pollution (MCK channels, fuel storage, workshops, and fishponds) will be repaired and graves will be relocated.

Slope stabilization is required in the two upper dam areas prior to inundation. This is described in Section 4.4.3.

4.3.2.3 Preparation of the buffer area

Each reservoir has a green buffer or management area along the perimeter, approximately 5 m above the highest water level, that has been acquired by PLN and forms part of the project footprint. This section will be revegetated to achieve three objectives: the establishment of boundaries for the community to access to the reservoir area, habitat restoration and control of habitat. This is particularly important in the upper reservoir or the upper weir which has a water level fluctuation of ± 19 meters.

The vegetation will be restored with native species which can provide habitat for native fauna and stabilize the soil to prevent erosion. Revegetation activities will start from the construction stage and will continue through the operational stage in accordance with the BMP.

4.3.3 Tunnels and Power Plants

During the power generation process, water will be channeled from the upper reservoir through the inlet, headrace tunnel and penstock pipe to the turbine in the underground powerhouse. From the power plant, water will be channeled through a tunnel to an outlet in the lower reservoir. These are collectively referred to 'waterways' along with surge tank in the tunnel.

The power plant and transformer will be located underground, along with control rooms, offices, warehouses, guard posts and parking lots. Access to the power plant will be via a tunnel road. Two other tunnels are required for ventilation and wiring.

The waterway, underground power station tunnels, holes for the transformer and access tunnels will be excavated using a combination of demolition, drilling and excavation. Work will start from the bottom up. The excavated material will be taken from the portal for disposal on the riverbank, as shown in Figure B3, Appendix B. To stabilize the rock, injection of cement mortar (grouting) and rock bolt will be used. After the stabilization process, shotcrete or concreting will be applied to strengthen the tunnels and holes formed. The penstock pipe will be made of steel.

The concrete plant, with a capacity of 60 m^3/day, will supply concrete for the waterway and power plant construction.

4.3.4 Terminator Yard, Switchyard and Administration Building Cables

The terminator yard cable is approximately 4,080 m long at the entrance to the tunnel cable. The switchyard length is 71,225 m. The above-ground administration building will consist of the main administration building, switchyard control, dam control, workshop and garage, guard house, prayer room, temporary project post and housing. See Figure B8 and Figure B9 (Appendix B) for construction sites and buildings.

Vegetation clearance and earthworks is required to provide a level area for these facilities. Materials from excavation and from other work parts (such as tunneling and power stations) will likely be used here as fill.

4.3.5 Transmission Network

Two 500 kV transmission lines will connect the Upper Cisokan Power Plant with the Java-Bali Network on the Saguling-Cibinong network in the North (15.5 km and 15.9 km). The total length of the new transmission lines is 31.4 km, and the 'free space' corridor is 34 m long. The towers and corridors will require an area of approximately 100.38 ha consisting of agricultural and plantation land. The connection locations on the grid have been selected, with detailed modeling of the Java-Bali network, to maximize the efficiency of the Upper Cisokan Pump Hydropower Plant and the limitations and redundancies of the existing transmission line system. The 500 kV UCPS transmission line route is shown in Figure 18.

The first route stretches from Lembur Sawah Village, Sukaresmi Village, Rongga District, West Bandung Regency to Sukadana Village, Haurwangi Village, Haurwangi District, Cianjur Regency. There are 37 towers on the first line, which has a line length of 15.5 km. The second route is from Lembur Sawah Village, Sukaresmi Village, Rongga District, West Bandung Regency to Leuweung Kalong Village, Ramasari Village, Haurwangi District, Cianjur Regency. The number of towers in the first line is 45 with a length of 15.9 km.

The total number of towers for the construction of the transmission lines is 82 towers and the total land area is 105.26 ha. The land requirement for the free space corridor is approximately 100 ha (31.4 km long, 34 m wide). Land for the towers has been acquired and compensation has been delivered to all but 1 landowner, who is living in another province. The Transmission line LARAP 2011 identified lands to be affected by the Right of Way, but will need to be reconfirmed. Based on Minister of Energy and Mineral Resources Regulation Number 27 of 2018, PLN, as the project owner, is obliged to pay compensation to holders of title to land, buildings and/or the plants associated with land, buildings and/or plants that suffer a reduction of economic value due to being crossed by an electric power transmission network, whether in activities of construction of a new electric power transmission network, activities of replacement or addition of new towers/poles, or expansion of the area/width of the right of way and minimum horizontal and vertical axis safe distance corridors of existing networks. The formula for calculation of the compensation is stipulated in this regulation. Compensation must also be paid for damage to buildings and plants that occurs during the construction of an electric power transmission network. Details of the location and number of towers on the transmission line are presented in Table 12.

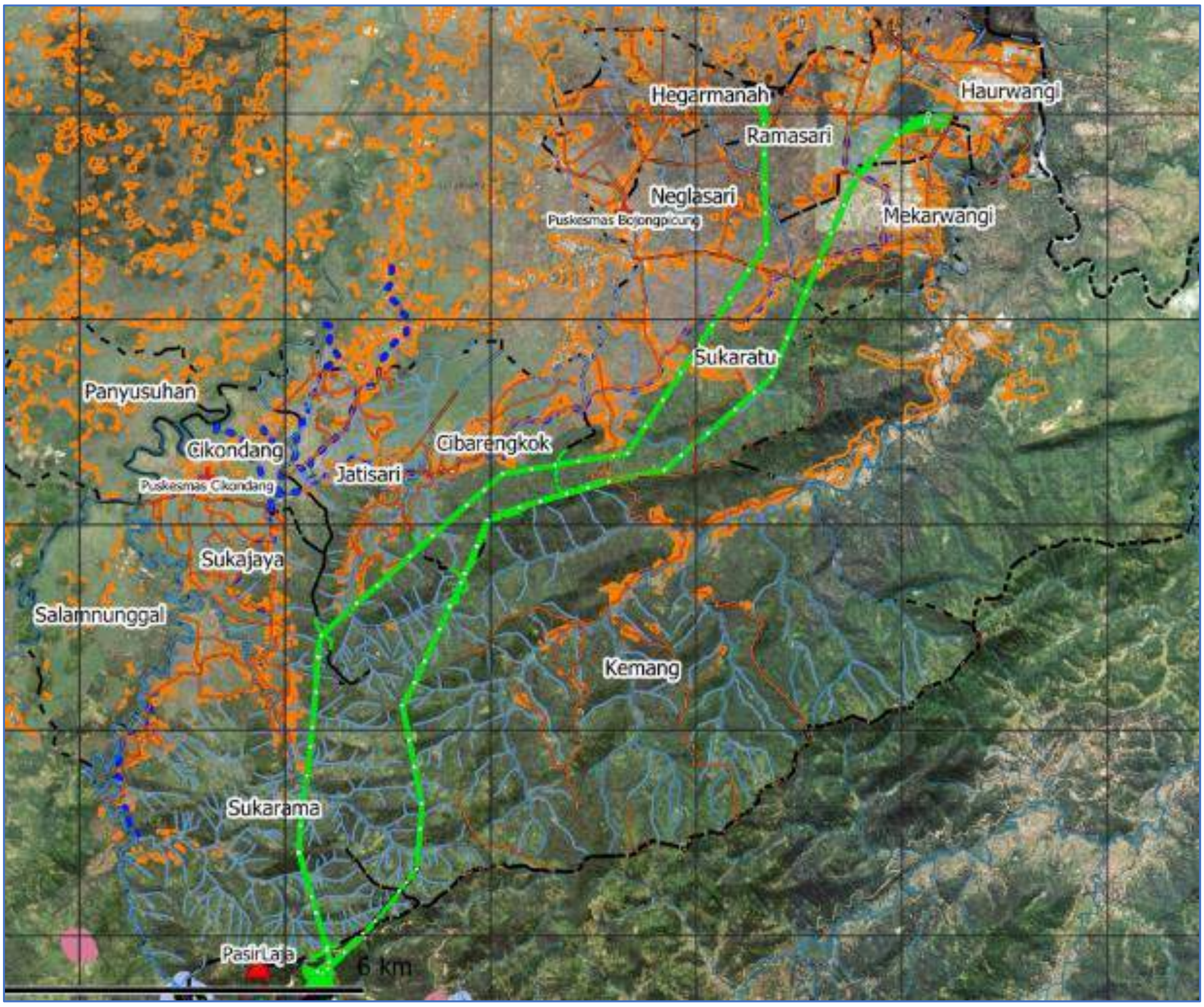


Figure 18. Transmission Line Route

Table 12. The number of power transmission 500 kV towers in each village. Source: (PLN, 2019a)

No	Regency	Districts	Village	Number of Towers Path 1	Number of Towers Path 2	Number of Towers Total
1	Bandung Barat	Rongga	Sukaresmi	4	3	7
2	Cianjur	Bojong Picung	Sukarama	1	7	8
			Kemang	16	1	17
			Sukajaya	-	2	2
			Jatisari	1	3	4
			Cibarengkok	5	5	10
			Sukaratu	11	11	22
			Neglasari	-	2	2
		Haurwangi	Sukatani	5	-	5
			Ramasari	-	3	3
			Haurwangi	2	-	2
Total				**45**	**37**	**82**

4.3.5.1 Design

The transmission infrastructure has been designed according to national codes and standards (PLN/Newjec Inc., 2007a). The steps below are to be implemented on a 500 kV transmission line:

- Technical aspects (length of planned transmission network, topography, soil characteristics);
- Minimizes the length of the path;
- Avoid settlements, farms and structures whenever possible; and
- Environmental aspects - such as vegetation clearance requirements and watercourses.

82 new towers will be built along the two routes. The ideal location for each tower has been determined through a land survey, based on topography, land use and access to the tower location and location will be determined through negotiations with the landowner.

The new network will be linked to the existing substations on the grid. There will be no other electricity infrastructure needed.

4.3.5.2 Transmission Line Construction

The tower construction stage on the transmission line begins with the mobilization of labor, equipment and materials. Workforce mobilization includes implementers (craftsmen), intermediary workers (supervisors, surveyors) and experts. The number and qualifications of labor required will be adjusted to the needs of the job. All equipment and materials that will be used for the construction of the tower will be transported by medium capacity truck, while the conveying wire and wire hauling machines will be transported by trailer to the final equipment storage area.

Construction materials such as sand, cement, coral, concrete and other materials for tower construction will be transported by labor to the tower site. This was done because planning the tower location was relatively difficult. The time needed to mobilize tools and materials in the construction of 1 tower point is 1 day.

The stages of activities in tower enforcement work are as follows:

4.3.5.2.1 Excavation work and material transportation for the foundation

The land area required for the tower footprint varies depending on the type and height of the tower, but in this case a uniformity is assumed, namely 25 x 25 m^2. The foundation used is the beam type (bearing & chimney). Each tower has four (4) legs where each foot is planted on on its own foundation. The excavation dimensions will be adjusted to the dimensions of the tower foot foundation. The dimensions of the foundation are determined by the results of soil investigations and the type of tower used. The average excavation dimension is 2.65 x 2.65 m^2 at a depth of ± 2 meters, thus the excavation volume will be around ± 56 m^3 per tower. Part of the excavated soil is used for piling up the tower legs and the rest is used to fill the area around the tower so that the lower surface of the tower is higher than the surrounding area. For transmission tower foundations in certain locations where the soil bearing capacity is low, pier foundation will be made by bore drill.

Prior to excavation work, the installation of bow boards for the four tower legs must be carried out using theodolite. This is so that the tower is actually on the right center line, ensuring that the excavation axis is in the right position, and the depth will be met.

The transportation of materials such as sand and gravel must be carried out immediately so that after the excavation is complete, further work can commence with delay. The excavation and material transportation work each took 1 day for every tower.

4.3.5.2.2 Repair work, scaffolding and stub setup

Iron work is a fabrication for each type of tower foundation, while scaffolding work is a formwork. A stub is a piece of the lower leg of the tower that is planted in the foundation but left a few centimeters for the purpose of installing the tower.

After all excavation work and the measurements including the depth are completed, the next step is to make a working floor for each excavation, followed by ironing and installing the formwork for the plinth, installing the stub, then ironing and installing the scaffolding in the chimney. The excavated land is spread out for landfill work and the rest will be deposited appropriately. The time required for cleaning, scaffolding and stub adjustment is 2 days for 1 tower point.

4.3.5.2.3 Foundation casting

Building the foundation is a very important job and determines the quality of the concrete, in this case reinforced concrete, so that the foundation can handle both tensile and compressive loads. This work takes 1 day for each tower point.

Preparatory work such as the availability of equipment: concrete mixers (mobile), water pumps, gutters for casting, hoes, shovels and other aids for slump testing, cubes for sample testing and others, are very important. To check stub position, theodolite must be available during casting. All materials must be available in sufficient quantities, because the casting of one part of the work must be carried out continuously until completion. When this preparatory work is finished, the first thing to do is casting the bearings. When casting the pad, the stub position must be maintained according to the tower type, both the level, diagonal slope and the ½ diagonal distance of the flashlight tower are controlled using theodolite and lot for the slope.

Casting is carried out continuously until the casting of the chimney is complete and the foundation of the four legs of the tower is complete. The slump test is carried out every 1 time mixing and 3 samples of test cubes are taken on the pad and chimney for each leg.

4.3.5.2.4 Hoarding work

After the concrete is aged for about 3 days (concrete mixture with additives), the scaffold, and template/ span coupler can be opened. Then a final check is carried out on the slope, side to side distance, diagonal distance, stub height, and the physical condition of the casting. If all measurements have met the specified size, heaping of the tower legs can be done and grounding can be installed. The time required for backfilling work for each tower point is 1 day.

4.3.5.2.5 Tower Installation Work

Before this work is carried out, the tower foundation must be at least 1 week old (concrete mixture with additives) and the landfill work must be completed. Transport of tower materials must also be completed, including the nuts and bolts.

Mobilization of personnel and equipment such as chain blocks, pulleys, scaffolding, straps, hand/ machine winch pullers, saws, files, galvanized paint and others must have been initiated. Tower materials placed in tower locations must be protected from contact with the ground, avoiding possible galvanic damage and other preventive work. The tower material used is high strength, hot dipped angle steel.

Tower installation is carried out in stages, segment by segment and foot by foot. First is the leg (leg), then the body/ extension of the body, the standard body part, the body part for the cross arm (lower, middle, upper and ground cables). The tower building process takes 20 days for each point of the tower.

After the tower is standing, checking the tightness of the bolts, the nut, the position of the bracing, the completeness of the bolts that are installed, the alignment of the tower is crucial. Before the installation of the work is completed, the measurement of the resistance of the tower legs is measured.

Grounding, in the form of galvanized wire, is planted around the tower with a distance of ± 1 m from the chimney and 2 feet high diagonally connected to the hole in the stub. If this ground resistance exceeds 10 Ohm, then an additional second grounding ring must be installed until the result is ≤ 10 Ohm.

4.3.5.2.6 Stringing

After the tower has been installed, the insulator is attached. After all towers have been installed with insulators, the nylon rope is drawn through the ground that functions to pull the conductor pulling cable. The pulling cable will be used to pull the conductor with the help of cable pulling machines. Pulling the conductor (stringing) is the withdrawal/installation of the conductor and grounding cable which includes sagging, clamping, jumper & counterweight installation, vibration damper installation, and spacer damper. A double circuit is planned with a vertical arrangement, installed on a double circuit tower.

The conductors to be used are Gannet type Aluminum Conductor Steel Reinforced (ACSR), while the ground wire uses GSW (Galvanized Steel Wire) and OPGW (Optical Ground Wire).

The composition of the per-span-phase conductors is Quadruple bundle conductor (4 per-phase conductors equipped with a spacer damper), while the stringing equipment consists of the engine winch puller, tensioner, roll block, anti-twist pilot wire, steel wire / wire rope, yoke, hydraulic cutter, compression. point machine, chain block, hand crane, nylon rope, mobile crane, and practical speaking apparatus.

4.3.6 Access roads and temporary roads

A 27km long new access road has been built from the Cipari Intersection to the project site, in addition to improvements to the existing 7 km of road from Mount Karang Quarry to Cipari Intersection, providing access for heavy vehicles to and from the project area, hauling quarry materials, mobilization of construction materials, and the movement workers and site visitors.

The road from Mount Karang to the upper and lower dam sites is shown in Figure 19. The existing road from Mount Karang to Cipari Intersection in Cipari Village has been widened and repaired along the road, with new asphalt and traffic safety features. The remaining roads, from Cipari Village to the upper and lower dam sites, are entirely new roads.

Settlements and buildings are located within a few meters of the existing road. Along the track there are three schools and a separate volleyball court that belongs to one of the schools. The road is used by pedestrians, bikers, motorists and small trucks.

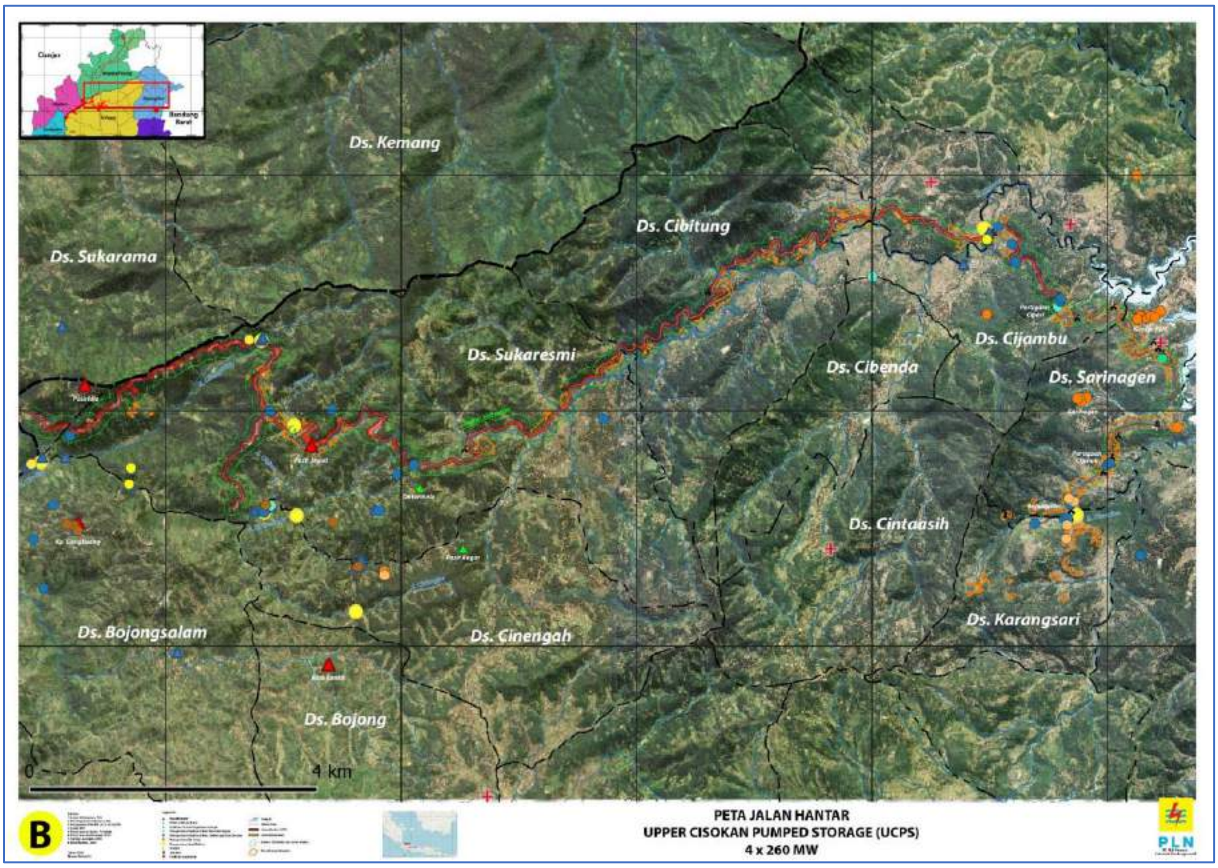


Figure 19. Map of access road, surrounding landscape and land cover, and villages

The new road has parallel width for safety and technical requirements based on detailed road technical design (as much as 20 m which is the allowable slope but, in some areas, it can be up to 40 m where steep slopes require more) (Figure 20). This route has been selected based on the topography and existing land uses, in order to minimize social problems and environmental disturbances wherever possible. This route passes through mixed forest and agroforest areas and mostly avoids rice fields (Figure 19). Six bridge pylons have been built along the track and are designed according to Indonesian road standard designs.

The roads have been designed to accommodate the following transportation construction needs:

- Civil engineering contractor movement;
- Transportation of rock materials for the construction of the Dam-RCC and the manufacture of concrete, and;

- The movement of electrical and mechanical contractors;
- Access to personnel and inspection lines when the project is operational.


Figure 20. Access Road Conditions (May, 2020)

Small roads will be constructed along the working area, between the access road, concrete plant, dam, tunnel, tunnel entrance and other working areas. Approximately 5,000 m of roads will be constructed towards the upper dam area, and 16,000 m of roads in the upper and lower dam areas. More than 6,000 m of temporary roads will be required during the drainage facility construction. These roads are between 6 and 10 m wide and will continue from new access roads.

Demolition will probably be required to access the left bank of the river from the lower dam. Except for a small section of the road leading to the level tank area, these roads will not be paved, but will be repaired using compacted excavated rock.

4.4 Infrastructure Construction, Programs and Manpower Management

4.4.1 Quarry

The quarry that already exists on Mount Karang will be used as the main source of basic material for the construction of roads and dams. Previously the quarry was used for the construction of the Saguling dam and was of a good volume and quality for the basic construction materials (roller-compacted concrete, RCC). The estimate of the total demand for materials from the rock is 2,710,000 tons or 3.69 million m^3 (PLN/Newjec Inc., 2002).

The rock will be blasted and excavated from the surface, cleaned by bulldozers and diggers and carried by large trucks. Large trucks will only transport rocks over short distances from the quarry surface to the crusher. The crushing site, using the dry process with a capacity of 120 tons/ day, used for road construction materials, and 150 tons/ day for RCC concrete construction for dam construction materials. Contractors have also been given the option of using a wet process, which is easier to do in the rainy season.

Trucks will be used to transport materials to the construction site. RCC dam building will continue and will require a continuous supply of materials. A 60 ton/hour asphalt plant will also be located in the quarry and will receive electricity from a diesel generator.

4.4.2 Materials and Waste Management

A summary of the estimated volume of minerals and main construction materials can be seen in Table 13 from the total quantity data in the Detailed Design report (PLN/Newjec Inc., 2002).

Table 13 Summary of Volume Estimates in Major Excavations and Construction Materials

Estimated volume of the main mineral (m^3)			Estimated volume of main construction materials (m^3)					
Location	Open excavation	Tunnel excavation	Excavation of rocks	Asphalt	Basic materials, sand and gravel	Ordinary concrete	Roller compacted concreter	Concrete block
Upper Dam	437,500		15,800			119,900	234,000	
Lower Dam	377,500	7,000	37,700			111,500	403,900	
Cliff Stabilization	32,500		38,700					3,800
Inner Way				560	2,800			
Waterways	225,500	428,500	10,600	130	2,400	141,100		
Underground power house	275,200	304,400		860	2,300	69,700		
Switchyard and Admin	621,100		460,000	1,300	17,700			
Total	**3,245,300**	**739,900**	**849,800**	**38,850**	**181,700**	**443,600**	**637,900**	**3,800**

4.4.2.1 Source of Materials

Rocks for RCC and basic materials for road construction and regional stabilization will be taken from Mount Karang. Other main construction materials are taken from other parts of Java. Other materials include cement, fly-ash, asphalt, shotcrete, cobblestone, mortar, concrete blocks and wire mesh for shotcrete.

Surface soil, weathered rock, and crushed rock will largely be recovered from the construction of dams, drains, powerhouses and will be used where possible for base materials and fillings.

4.4.2.2 Waste

There is an excess of minerals compared to the filling materials required in the project. Disposal sites for excess materials have been located, as shown in Figure B5, Appendix B. Reservoir dead storage areas have been proposed for disposal locations where practical. For stabilization purposes, the process is to cover the soft soil with weathered and coarse rock. Dumps that will not be inundated under the reservoir will then be shaped and covered with surface soil. Land may be replanted with native vegetation, depending on the location, community / ecosystem needs and technical suitability.

4.4.3 Slope stabilization

Cliff stabilization is required in the two upper dam areas before inundation. The locations are A and C, as shown in Figure B9. Sliding Zones and Slope Figure B9, Appendix B. The standard method is to cover the bottom of the landslide area with gabion and concrete. The gabions will be filled with tunnel-excavated materials. Protection devices will usually be located in the lower and upper water boundary zones. This is useful for protecting areas where there is a risk of landslides from drastic changes in water level. Slope stabilization is carried out on slopes that have a large potential for landslides in the upper weir.

4.4.4 Worker's barracks/ basecamp, offices and additional work locations

The location of workers' barracks/ basecamp, offices, and additional work areas can be seen in Figure B9, Appendix B.

4.4.4.1 PLN Project Office

The PLN project office has been built in Ciangkrong Hamlet, Sarinagen Village, Cipongkor District, West Bandung Regency. The building will include offices, accommodation, a clinic, a dormitory hall, a mosque and entertainment facilities.

4.4.4.2 Main Contractor's barracks/ basecamp

The barracks used in the new road access construction project were reused as the contractor's base barracks. The area is 150 m x 200 m and includes offices, special staff areas, storage warehouses, dormitory halls, explosives warehouses and services for workers.

4.4.4.3 Upper Dam

Upper Dam Barrack/ basecamp B will be constructed close to the upper dam area. Its main facilities are offices, service vehicle workshops, laboratories, construction workshops, workers canteens, explosives warehouses, storage sheds, special technicians' areas and a dormitory hall. The barracks/ basecamp will have a diesel generator to provide electricity.

4.4.4.4 Lower Dam

At the lower dam there will be two workers' barracks/ basecamps, barrack/ basecamp A (Lot 1) and Barrack/ basecamp A (Lot 2), a barrack/ basecamp for the contractor’s office and workshop (Barracks/ basecamp B Bendungan Bawah), and a barracks/ basecamp for workers and technicians (Barracks/ basecamp C Dam Bawah). The facilities are the same as those in the Upper Dam.

4.4.5 Water, Sanitation and Solid Waste

Drinkable water will be channeled to basecamps and office areas. Water from tributaries will be pumped into storage tanks, then treated and channeled to various buildings. Water from the river will also be taken for the manufacture of concrete at the plant.

At the site, a solid waste processor will be built. The waste will be disposed of to the local waste disposal site. A disposal system will be built in each of the barracks/ basecamps, to treat wastewater before it is discharged into the septic tank.

4.4.6 Electricity Supply

Electricity will be supplied to the main construction areas, quarry and barracks/ basecamps via the 20 kV power grid from the Cianjur or Saguling power stations, supported by standby diesel generators in primary locations. This power pole will be constructed as part of the project, the 30 km line can be seen in Figure B8, Appendix B. The path will follow roads where possible, but some trees may need to be cleared to erect the poles. The concrete poles are 9-15 m high, and the maximum distance between poles will be 60 m. Masts may also be installed on site and used for communication cables and lighting.

The crushing and asphalt installation in the mining area will be operated by diesel generators. Other standby generators will be provided around the construction area. For underground power generation facilities, eight sets of 500 kVA diesel generators will be used during the construction and project period. The electricity at the basecamp will be generated from the existing generator or PLN network.

4.4.7 Mobilization and Traffic

Heavy equipment will be transported through the Tanjung Priok port in Jakarta. Engineers have marked the selected route for the transportation of heavy equipment, mechanical equipment, materials and other heavy equipment with contractors from Tanjung Priok to the project area which will reduce the number of winding or steep roads and gain smooth road access (PLN/Newjec Inc., 2002). This route was used for the Saguling and Cirata hydropower projects during the construction period with a total distance of approximately 250 km.

All transportation, including materials from Quarry will use the transfer road from the Cipari Interchange. The most frequent flow of vehicles originates from the quarry to the dam site, during the construction of the RCC dam; estimated at 16 transport flows per hour for 12 hours a day.

4.4.8 Construction time

The estimated construction completion time will be 3.5 years for the main works. The construction process has begun with a 1.5-year process of building an access road and the land acquisition process.

4.4.9 Labor

The total number of workers required during the construction period is estimated at 2,700 peoples including skilled and non-skilled workers. The policy is to recruit local residents according to their respective fields of expertise. Approximately 60% of workers are estimated to be unskilled laborers. Accommodation, food and basic necessities will be provided at the workers base camp for the workers.

4.5 Required Land

The total land area required for the UCPS project is approximately 731.76 ha, consisting of 310.06 ha of privately-owned land, 12.16 ha of village treasury land, 0.54 ha of waqf land, and 409 Ha of forestry land. The total percentage of land that has been acquired by February 2021 is 721.92 ha equals to 98.65%. (see Figure B12 in Appendix B).

4.6 Reservoir Preparation and Inundation Process

The inundation process will begin once the dam is fully constructed, the slopes have been stabilized and the reservoir has been cleared of vegetation and sources of contamination in accordance with the Reservoir Preparation Plan. The diversion structure in the upper reservoir will be dismantled and the diversion tunnel in the lower dam will be permanently closed.

Inundation will occur during the rainy season (December to May), when river flows are higher and there is less risk of low flow conditions. It is planned that the Indonesian Large Dam Safety Committee will approve the initiation process of flooding the dam.

Water demand and the estimated volume of water available for filling are presented in Table 14. The total water required to fill the reservoirs prior to commissioning is 63,530,000m^3. The live storage area in the upper reservoir will not be filled during inundation, since it will remain 'empty' and available for the water to be pumped from the lower reservoir as part of the commissioning process.

PLN will first prepare a Reservoir Filling Plan covering the reservoir filling schedule, including holding points/elevation, surveillance and notification procedures, frequency of instrumentation readings, thresholds for triggering alarms, notification and warning procedures together with the Operational and Maintenance Plan, no less than six months prior to the initiation of filling.

All water filling requirements will come from the Cisokan River. Based on the 2014 decree and PLN's water resources utilization permit (Section 2.3.8) the maximum water debit of the Cisokan River that can be utilized is 6.21 m^3/s. Therefore, the UCPS will take up to 6.21 m^3/s to fill the reservoirs and will release the rest downstream of the dam. All inflow from the Cirumamis River will be discharged via the upper dam bottom outlet during inundation. Water may be pumped up to the upper reservoir periodically during filling or during the commissioning period.

The estimated total number of days to fill the reservoir is 122 (four months). The water balance is simply set based on the average flow conditions and does not include other losses of the hydrological system apart from reservoir evaporation and residual flow discharge downstream from the lower reservoir.

Table 14. Water Balance During Wet Season (Dec – May) Inundation

Water required	m^3
Upper reservoir filled to lower water level (dead storage only):	530,000
Lower reservoir filled to upper water level (dead and active storage):	63,000,000
Total [f]:	63,530,000
Average daily water balance	**m^3**
Average daily inflows to the scheme [a]	1,892,160
Maximum daily retention of water in the scheme @ 6.21m^3/s [b]:	536,544
Average daily evaporation [c]:	17,000
Average daily outflow from the lower dam [d]:	1,338,616
Estimated number of days to fill [e]:	122

Notes:

(a) Only the Cisokan River. The range of average monthly mean flows in the Cisokan River @ Lower Dam in the wet season is 15.82-27.2, the average of this data is 21.9.
(b) UCPS will take up to 6.21m3/s. Less water will be retained if the inflow drops below 7.91 m^3/s to ensure there is a minimum e-flow of 1.7 m^3/s.
(c) Evaporation
Average daily evaporation is determined based on a value of 5 mm / day (17,000m3/day, 0.2 m3/s), and the full reservoir area is about 80 ha for the upper reservoir and 260 ha for the lower reservoir. This is conservative, because the surface area of each reservoir is less than that number at the time of filling, but it will have little effect on the total number of days required for filling.
(d) Inflow minus retention minus evaporation
(d) = (a) – (b) – (c)
(e)
Total water required (f) divided by (b-c), rounded up to the nearest number of days.
The estimated number of days is the minimum, as it is based on the maximum water retention rate in the scheme of 6.21m^3/s. If there are periods of low flow then less water will be retained in order to release water downstream of the lower dam to meet the e-flow requirements (described in more detail Section 10). The minimum e-flow during inundation is 01.7m^3/s.

4.7 Operations of the UCPS Hydropower Plant

The UCPS hydropower plant will be used to meet energy demands at peak loads and will pump water for storage during off-peak periods.

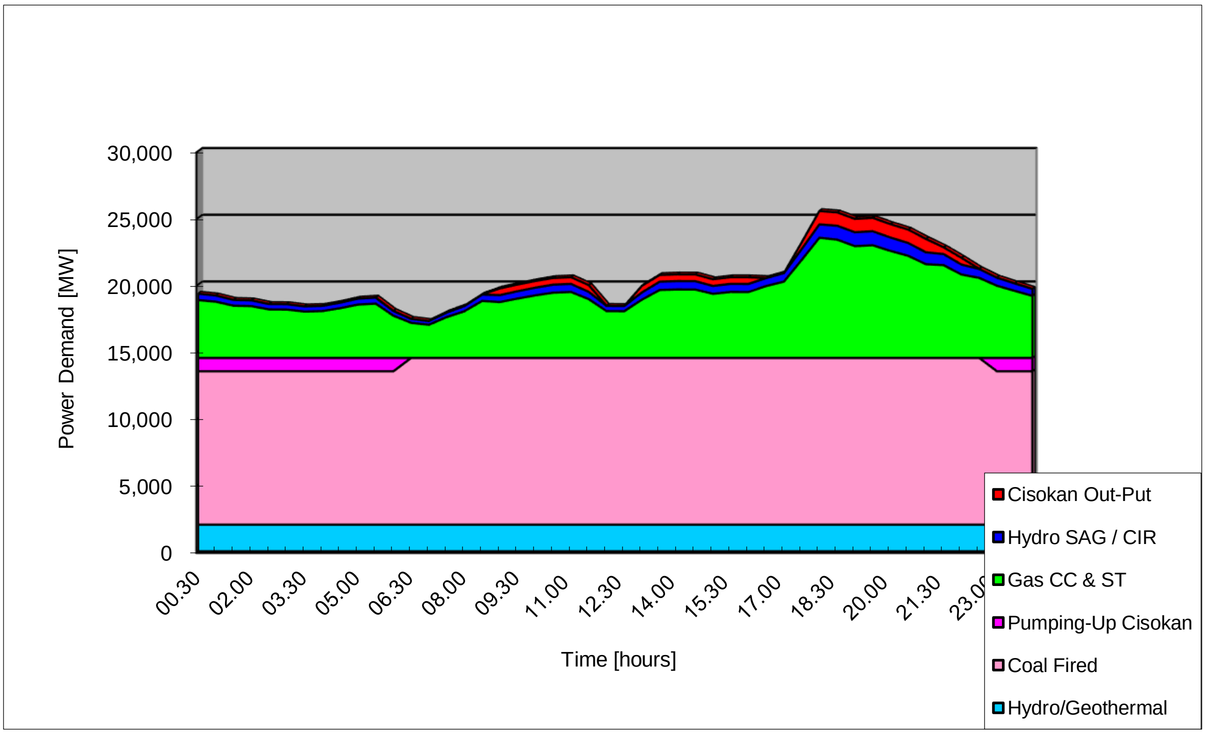


Figure 21. Model of Daily Needs of Electricity required by the Java-Bali Network in 2012, Shows Daily Power Generation (output) and the Pumping Cycle of the UCPS Hydropower Plant. Source: PLN/Newjec Inc., 2007d

If energy is produced at full power, the maximum duration is 6.5 hours. In practice, the power plant operate on a certain scale and at the time required. Based on the daily pumping scale, the total pumping duration is 8.5 hours. The pumping process normally takes place throughout midnight and early morning, during of low base load times.

The pattern of daily energy production and pumping is shown in Figure 21, from an example of potential daily electricity demand in the Java-Bali network in 2012 (PLN/Newjec Inc., 2007b).

The Upper Cisokan hydropower plant is a net consumer of electricity. However, this condition remains economically efficient and profitable as shown in sections 1.2 to 1.3.

The upper reservoir's operating water height range is 19 m. At maximum power generation, the average water drop is approximately 3 m/h, or 48 mm/min. This average rate is considerable. At maximum average pump rates, the average filling rate is approximately 2.25 m/hr. The range of the lower reservoir operating water level is approximately 4.5 m. At the maximum average electricity generation, the rate of drawdown is approximately 0.7 m/hr.

4.7.1 Water Requirements during Operations

When both reservoirs have filled during the initial inundation phase, the Upper Cisokan Pumped Storage Hydroelectric Power Plant will only need a fraction of the total inflow to maintain the water level required for replacement. The water to be retained in the reservoir is to compensate for evaporation losses, estimated at 17,000 m^3/day (see Table 14). The majority of the 'top up' water is likely to originate from the lower reservoir with the larger watershed of the two dams. Therefore, the majority of the inflow from the upstream catchments will be passed downstream by the upper and lower dams, via bottom outlets and spillways. The hydrology and e-flow regime are discussed in detail in Section 12.2.3.

The bottom outlet of the upper dam is adjusted to allow a maximum discharge of 0.96 m^3/s, but will discharge an average of 0.5 m^3/s based on the average river flow. The discharge of the water will flow directly below the dam into the Cirumamis River. The discharge flow will decrease in accordance with the reduced natural inflow into the reservoir (dry season and dry period in the rainy season). The maximum discharge of 0.96 m^3/s will be achieved during the rainy season or during high rainfall. Any discharge greater than 0.96 m^3/s will be discharged via the spillway when the reservoir is at full capacity.

The bottom outlet of the lower dam can be adjusted to allow maximum emergency water discharge, up to 39.9 m^3/s (PLN Enjiniring/Nippon Koei/Newjec Inc./Indokoei International/Wiratman, 2019a), but will discharge up to 13m3/s during normal operations. Any flows greater than 13.0 m^3/s will be discharged through the spillway when the reservoir is at full capacity. Discharge flows will equal inflow except when inflow is at or below 0.01m^3/s, the lower dam will maintain at least 0.01m^3/s.

4.7.2 Reservoir Access and Management

Reservoir management refers to the biodiversity management plan which provides a reference model for conservation in each area unit.

Due to security issues around the site, as well as the unpredictable water levels of the UCPS hydropower plant during the operational period, the reservoir, buffer area and draw-down area will be managed in a different way from conventional hydropower plants.

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

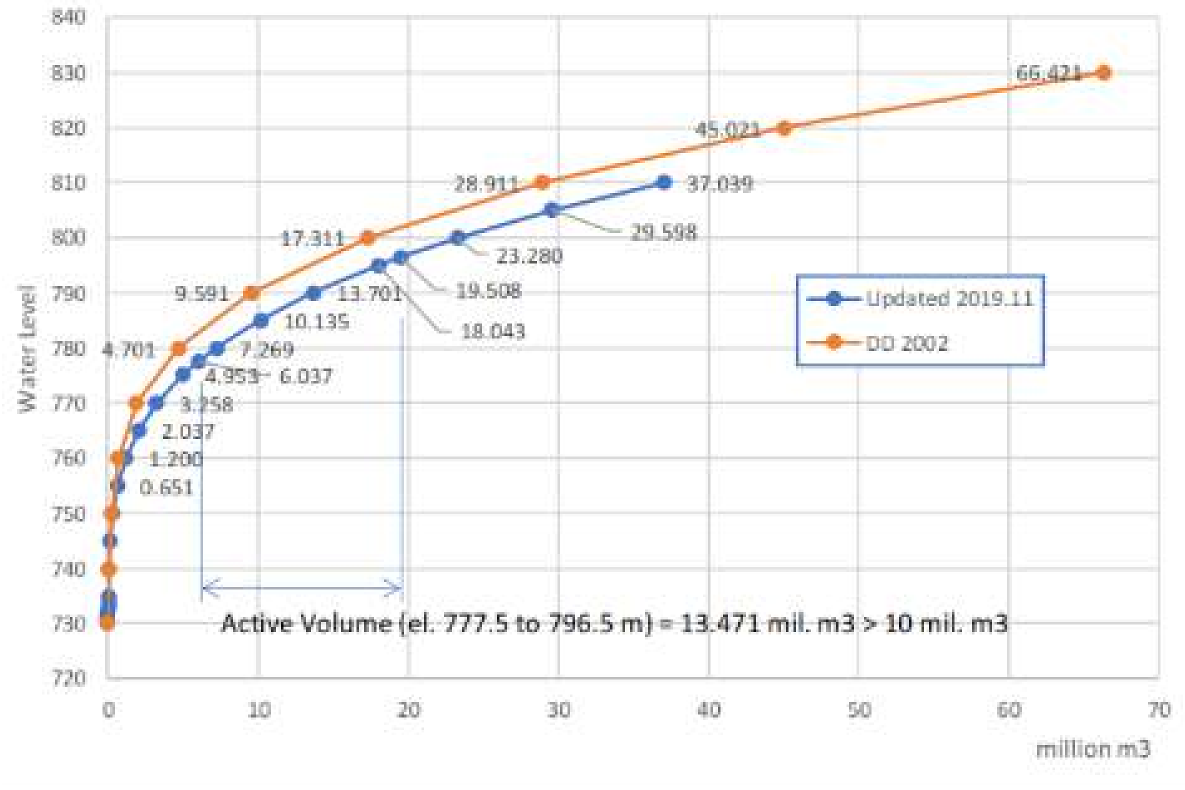
Safeguards will be documented in the Operational Environmental and Social Management Plan and include:

- Revegetation of 5m vertical buffer areas with native species or construction of cliff reinforcements to combat erosion and sediment control, and to provide forest as habitat for wild animals, as per the Biodiversity Management Plan. The reservoir buffer area will be managed by PLN and the community will not get access.
- Strengthening the drawdown area using vegetation and technical civilian methods is required because of the flow velocity due to the rapid increase and decrease in the water level.
- Routine patrols are carried out in buffer areas and reservoirs by security staff, and evacuated communities.
- A warning alarm will be installed before the power plant or pump to indicate whether the water level is rising or falling excessively in the reservoir.
- Warning signs will be placed at specific distances on the edge of each reservoir, and at locations around local roads and trails, explaining that community access to the reservoirs is prohibited, and that the water level may rise without warning.
- Regular education programs (started during the construction stage) to explain to the local community how the reservoir will be operated, and what safety risks are involved.

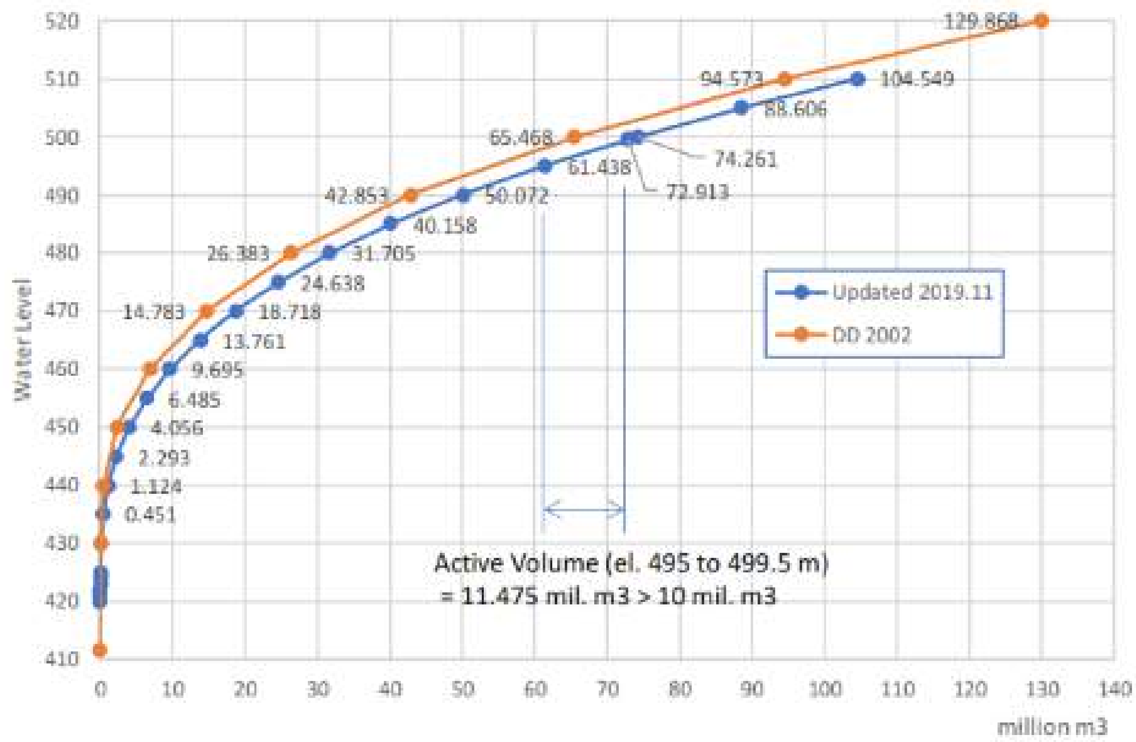
To ensure the quality of water protection and operational efficiency, the reservoir will be regularly cleaned to remove water weeds and material floating in the water which impacts the water input to the turbine.

4.7.3 Reservoir Sedimentation

The lower watershed area of 355 km^2 and the upper reservoir of 10.5 km^2 were used to predict the amount of sedimentation. The Cisokan hydropower plant has been designed for a period of 50 years with an estimated average sedimentation of 1.86 $mm/km^2/year$ (PLN Enjiniring/Nippon Koei/Newjec Inc./Indokoei International/Wiratman, 2019b; PLN/PT. Geotrav Bhuana, 2013). The total volume of the lower reservoir is 53 million m^3. After 50 years, the sedimentation volume is 33 million m^3, this means that there will still be 20 million m^3 of space for further sedimentation (Figure 22). For the upper reservoir, the total volume is 14 million m^3 and active storage is 10 million m^3. After 50 years, the sedimentation volume will amount to 1 million m^3, this means that there will still be 3 million m^3 of space for further sedimentation in the upper reservoir. Figure 23 shows that both reservoirs have sufficient volume to overcome sedimentation for a period of 50 years.

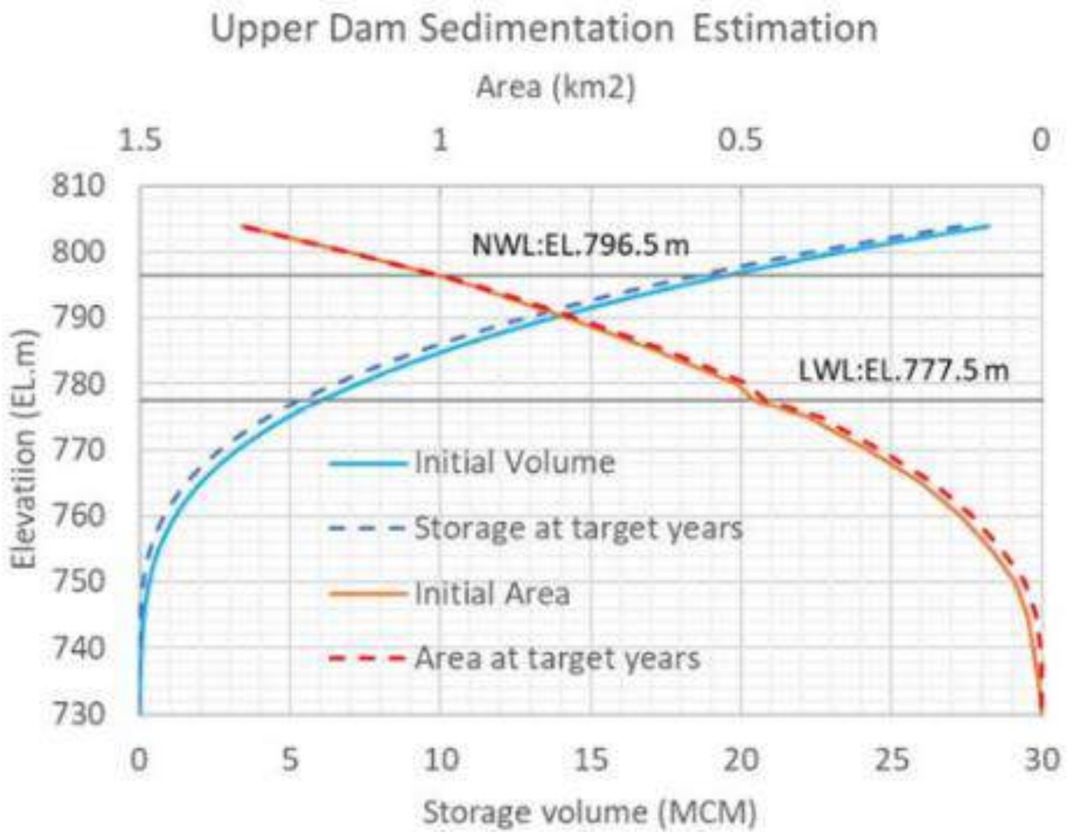


(a)

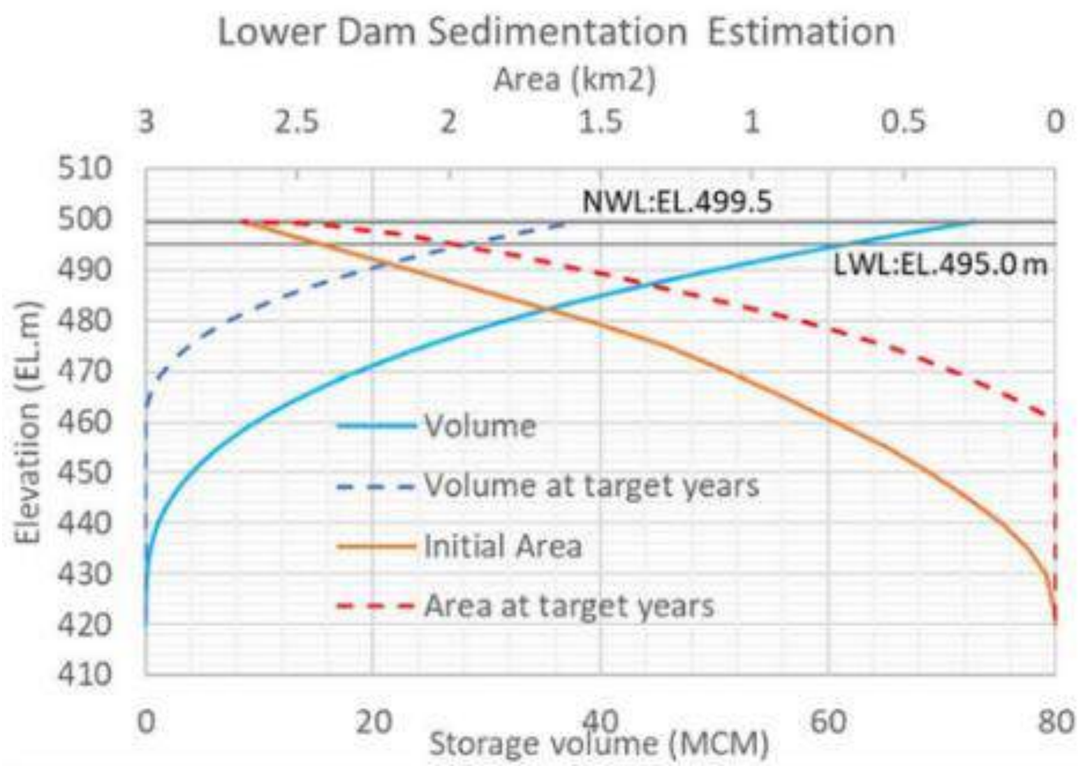


(b)

Figure 22. Curve H-V in (a) Upper Dam and (b) Lower Dam



(a)



(b)

Figure 23. Curve H-Q in (a) Upper Dam and (b) Lower Dam

4.7.4 Flood Emergency Operational Procedure

Due to the lack of active storage, the flood inflow has a very short duration of time in the reservoir system, and so the flood flow will not be completely exhausted. However, there is still a possibility that large flood inflows could occur alongside the generation of electricity (and/or when the lower dam is full) requiring flood warnings for downstream river users on the Cisokan River.

4.7.4.1 Warning Methods

Flood warning to people in downstream areas will be carried out with:

a. Issue warning bulletin via warning car,
b. Announcing flood warnings through the public media, and
c. Notifying the public by providing flood warnings through noticeboards or sirens.

The warning sirens will automatically sound after the main post receives the water level data from the lower dam that the water level is higher than the flood water level.

4.7.4.2 Location of Warning Facilities/ Devices

A total of 20 warning signs regarding the risk of sudden water rise, including access restrictions, will be provided in publicly accessible locations near the dam and Manglid measuring stations and the Cihea dam. Its general location will be at:

a. common areas
b. infrastructure areas (dams, inflow, outflow, etc.)
c. other areas, which are passed by the community or are near villages.

Flood control will be carried out both automatically and manually, and data will be transferred via a radio network connected to the communication system at the power plant.

4.7.4.2.1 Community Consultation

Prior to the inundation period, and regularly throughout the lifetime of the project, all downstream river users and the community will receive socialization regarding the flood warning system and on how to protect themselves.

4.7.5 Electric Power Transmission Line

Once operational, electricity will be supplied via transmission from the UCPS power station to the 500 kV transmission network. There will be flexibility in terms of transmission of electricity, depending on system requirements. Due to its flexibility in connectivity, Upper Cisokan will become the main power plant in the Java-Bali network.

During pumping, the UCPS hydropower plant will receive electricity from the same transmission system.

Maintenance and inspection will be carried out periodically on the integrity of the tower structure, and the condition of cables and other equipment. In the forested part of the transmission line route, vegetation clearance will be carried out along the 34 m wide transmission line corridor. The soil stability around the tower will also be monitored regularly.

The 20 kV network (used for construction activities) will be created to provide standby electricity supply to power plants, as well as to distribute electricity locally within the UCPS hydropower plant area.

CHAPTER 5. ALTERNATIVES ANALYSIS

The Upper Cisokan Pumped Storage (UCPS) hydropower plant has been reviewed several times from an environmental, social, technical and economic perspective. This section will discuss alternatives related to:

- The Java-Bali Electricity Network without the UCPS hydropower plant
- Dam/ reservoir design
- Access road location
- Sources for basic materials for dam construction
- Streamlining the transmission network

5.1 Electricity Network System in Java-Bali without the UCPS Hydropower Plant

If the Upper Cisokan Pumped Storage (UCPS) hydropower plant does not generate electricity at peak load, the following scenarios have been mentioned in the additional design study (PLN/Newjec Inc., 2007b):

- The petroleum power plant will be used to carry the peak load. Very large costs will be incurred by PLN for power generation at this time.
- At minimum load, the coal power plant will slightly reduce its electric power in response to existing electricity needs. This results in a reduction of output efficiency.
- Cirata hydropower plant will continue to operate as a controlled power plant in accordance with the required load, mostly operated with an efficiency of 65% rather than 100%.

The ability to meet electricity needs during peak loads requires a reliable supply of electricity that responds quickly to fluctuations in electricity demand. This can be met by hydropower plants. As the plants can store energy and provide spinning reserves, hydropower can respond quickly to power fluctuations (unlike coal power plants) and is more economical than oil, diesel or gas. Design Detail Study (PLN/Newjec Inc., 2002) ruled out conventional hydropower as an alternative peaking plant due to the difficulty of finding an area large enough for a reservoir in the Java-Bali region, without s significant adverse social and environmental impacts, in particular the significant scale and cost of resettlement and loss of productive agricultural land and / or loss of natural forest habitats.

Matenggeng Pumped Storage Scheme is a feasible alternative to UCPS and PLN are currently preparing the detailed design. PLN propose to develop and use both pumped storage schemes in the Java-Bali grid.

5.2 Alternative Dam / Reservoir Configurations

An alternative location for the upper dam was considered in the 1995 feasibility study, which described the location of a smaller reservoir (PLN, Newjec Inc., 1995). The aim is to minimize the number of households and area of agricultural land that will be submerged. Initially, the upstream dam was constructed at the confluence of the Cipateungteung and Citapos Rivers, and excavated up to 15 million cubic meters of hillside within the dam site. The result is a deeper and steeper reservoir. This alternative was deemed unfeasible because of the very high costs, the risk of steep slopes, and the additional work required to excavate and stabilize large volumes of rock. The Cirumamis River location was considered the most feasible and safe, even though the resettlement costs and impacts would have been higher.

An alternative design was considered for the lower reservoir to reduce sedimentation. The option was to operate a dam and permanent diversion tunnel in the lower reservoir that could transport sediment loads from the upstream area of the watershed directly to the downstream of the dam. An additional benefitwas that the reservoir area would be reduced by 50 ha, and the reservoir height by 9 m. This alternative would have resulted in less land acquisition, resettlement and social impacts, and almost halved the operating zone within the reservoir. Less critical habitat would have been inundated. River sediment loads and the associated erosion and deposition impacts would have been closer to the natural river condition, compared to the current design. This alternative is more expensive, and therefore not technically recommended.

In 2019, the topographic measurements in the project area were updated according to the latest conditions. The following section outlines several new alternative design recommendations resulting from the 2019 UCPS design reviews and updates:

5.2.1 Hydraulic Design of Lower Dam Overflow Channels

The design in the previous study did not include the energy dissipator in the lower dam design. In 2015, a hydraulic model test was carried out so that a waterfall pond in the lower dam was needed as an energy dissipator.

Energy dissipation is required as a dam safety standard, especially for the downstream area of the dam. However, the construction of a waterfall pond will result in increased costs and land acquisition. Therefore, as an alternative, the non-gated spillway, stepped spillway chute, and stilling basin has been designed as an energy dissipation system to replace the waterfall pond (PLN Enjiniring/Nippon Koei/Newjec Inc./Indokoei International/Wiratman, 2019d). This adaption has had a neutral impact on the social and environmental impacts of the design.

5.2.2 Outlet Channel Capacity

The lower drain design of the previous study did not meet the safety requirements for an emergency drawdown mechanism. An emergency drawdown mechanism is required in case of emergency conditions such as deformation of the weir body, uncontrolled large leakage, and reservoir displacement due to landslides.

For this reason, changes have been made to the design of the outlet channel in the drain valve and the elevation of the inlet at the upper and lower dams. (PLN Enjiniring/Nippon Koei/Newjec Inc./Indokoei International/Wiratman, 2019d). This adaption has increased the safety to the community and workers during the operational phase compared to the earlier design.

5.2.3 Diversion Channel Design

The design of the diversion channel at the upper dam was carried out by a design update, from using shotcrete to concrete lining. which affects the flow of water in free flow conditions (PLN Enjiniring/Nippon Koei/Newjec Inc./Indokoei International/Wiratman, 2019d). The diversion channel at the lower dam was also extended in order to pass through the coffer dam, downstream of the dam (PLN Enjiniring/Nippon Koei/Newjec Inc./Indokoei

International/Wiratman, 2019d). This design change had a neutral effect on the environmental and social impacts of the scheme.

5.2.4 Open Ground Works, Switchyard, Office Buildings and Outlet Channels

Recent topographical measurements indicate the possibility of significant design changes in some open earthworks especially in switchyard design, office buildings and outlet channels.

Various switchyard design alternatives were made in accordance with the condition of the completed access road, because it is located under the slope traversed by the access road. Design alternatives in office buildings were done to minimize earthworks. These design updates have reduced the risk of landslides and erosion, reducing the associated environmental risks and reducing the risks to heavy machinery operators preparing the sites.

In the outlet channel, an alternative design is also carried out on the disposal structure and tailrace channel, as well as the installation of inclinometer at several points for monitoring deformations that could trigger landslides. (PLN Enjiniring/Nippon Koei/Newjec Inc./Indokoei International/Wiratman, 2019d). This has improved the safety of the structure.

5.3 Penstocks

In previous designs, the penstocks were connected via the shortest distance between the surge tanks and the power housing. This design results in a smaller work volume but presents challenges when constructing the angle of the shafts. Comparison of two alternative penstocks on vertical shafts has been carried out in order to obtain a cheaper cost and easier construction method (PLN Enjiniring/Nippon Koei/Newjec Inc./Indokoei International/Wiratman, 2019d). This will result in safer working environments. The environmental impacts on the change in volume of tunnel spoil between alternatives has a neutral effect because spoil will be stabilised within the dead storage area and increased spoil volumes in this area will not change the potential impact on biodiversity, water quality, land acquisition etc.

5.4 Quarry Alternatives

Analysis of the raw material sources for concrete aggregates, using maps and drilling data, following investigations were carried out in a detailed design. The three main rock types available in the area are lava, andesite & limestone (Table 15). Only lava and andesite were considered suitable because the limestone found was too scattered throughout the area.

Table 15. Summary of Quarry Location Alternatives

No.	Location	Distance from Upper Dam (km)	Method of Study	Rock Type	First Screen: Review Survey	Second Screen: Exploration Excavation
1	Gunung Karang *)	11	The existing quarry used for Saguling is owned by PLN	Andesite	Andesite on the surface.	The Andesite is hard and fused.
2	Gunung Kencana	7	Alternative feasibility study	Limestone and andesite	Andesite on the surface.	Breccia tuff, weathered, with a thin layer of andesite
3	Curug Walet	2	Excavation outlet	Andesite	Andesite on the surface. Part of water body / waterfall.	has long been oxidized

4	Gunung Masigit	10.5	Geological Map	Andesite	Breccias, without andesite	NA
5	Gunung Hejo	9.0	Geological Map	Andesite	Claystone/ sandstone, without andesite	NA
6	Pasir Dari	5.0	Aerial photo	Lava	Andesite/ breccia. Too thin.	NA
7	Cigombong	4.5	Aerial photo	Lava	Andesite/ breccia. Too thin	NA
8	Cisadea	5.0#	Geological Map	Andesite	Sandstone/ claystone layers. Many houses nearby.	NA

*) the alternative chosen
- Distance from lower dam
Source: (PLN, 2011a)

Gunung Karang was selected due to the quality of material and the ownership by PLN, reducing the land acquisition and resettlement[6] risks. The quarry had already been worked, meaning that the land had already been disturbed, the community was already aware of the quarry and its potential impacts and no significant biodiversity values were identified.

5.5 Alternative Access Roads

Three alternative access roads were considered during detailed design in 2002.

Table 16 Summary of Alternative Roads

Description	Route A	Route B	Route C (chosen)
Length new road	35km	31km	25km
Length existing road	0km	8km	8km
Total length	35km	39km	35km
Technical issues	Steep mountain slope south of Gunung Karang quarry makes the road risky for slope stabilization and erosion and expensive to build and maintain.	River crossings means additional kilometers to travel. Many settlements and agriculture, making resettlement difficult.	Possible to maintain elevation to the upper dam without river crossings.
Land acquisition	140ha	124ha	100ha
Land use issues	Many houses	Many houses, brick-stone factory, rice mill, rice fields.	Few houses, mostly agriculture and forest land.

Route C was selected because of the lower resettlement risks, impacts and costs. At the time of the analysis, biodiversity values weren't considered and compared, however all three routes would have traversed through modified critical habitat and would have had similar

[6] Although resettlement and social impacts became more complicated during project implementation, as discussed in the LARAP review.

scale of impacts. All routes would have provided similar opportunities for induced development and further degradation of the habitat.

5.6 Temporary Works Layout

Following the preparation of the BMP in 2015, modifications were made to reduce the direct impacts on habitat within the project footprints. Temporary works layouts changes included realignment of temporary construction roads and relocating spoil banks within the dead storage area of the reservoirs.

5.7 Reservoir Filling

In the 2011 ESIA it was proposed that the UCPS was going to use all available water from the Cisokan River during reservoir filling and release at least $7m^3/s$ as e-flow. Since 2011 PLN has changed the filling regime and obtained a permit to only take up to $6.21m^3/s$ and release all other water as e-flow during the filling period. The previous, alternative filling regime from 2011 would have maintained sufficient flow for the Cihea Irrigation Scheme but would have 'flat-lined' the river at the minimum e-flow for several months over the winter period. This impact was considered short term and not significant in the ESIA, however the new filling regime will have much less impact on the river habitat and the river will experience more natural flow in comparison.

5.8 Alternative Transmission Network Lines

Four alternative routes have been analyzed in the design study (PLN/Newjec Inc., 2007b). At the time, the aim was to find out how the construction of a 10,000 MW coal-fired power plant will change the distribution needs of the Java-Bali power grid. The four options were:

1. Initial design of the Detailed Design Report (PLN/Newjec Inc., 2002) – four single circuits connecting Cisokan to Saguling-Cibinong and Depok-Tasikmalaya.
2. Alternative 1 - Two connection lines to the Cibinong - Saguling electricity network to the North.
3. Alternative 2 - One line connection to the Cibinong - Saguling electricity network to the North.
4. Alternative 3 - Two radial connection lines to the power grid only in Saguling.

At the end of 2007, the Additional EIA (PLN/Newjec Inc., 2007a) stated the final configuration, Alternative 1 - two separate power lines to the North connecting the Cibinong-Saguling power grid. Alternative 1 was considered to be the best stable supply relationship on the power grid for the Java-Bali region. This decision is based on a review of the associated risks and monetary costs in the number of existing power lines, repair of the substation, maintenance and a review of the reliability of supply and the risk of a complete blackout if the electricity network or substation is removed from the system for maintenance or an emergency.

The route alignment was selected based on ground conditions for tower foundations and minimizing resettlement and the distance of construction access routes, and avoiding steep slopes or erosion prone areas. Resettlement was minimized by avoiding structures, buildings and productive land as much as possible. Biodiversity impacts were not considered in the configuration or route alignment.

CHAPTER 6. ENVIRONMENTAL BASELINE INFORMATION

6.1 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).
2007	ANDAL Report UCPS Cisokan (PLN/Newjec Inc., 2007b). ANDAL Report Transmission Line UCPS Cisokan (PLN/Newjec Inc., 2007a).
2009	Combined EIA Support Study, Biodiversity Survey (Rahmat, 2009).
2011	Environmental Impact Assessment.
2013	Watershed Management Study Report (Watershed Management) to support Upstream Cisokan Upper Cisokan Pumped Storage (PT. Geotrav Bhuana Survey).
2014	Biodiversity Management Plan, Universitas Padjadjaran.
2017	Key Species Monitoring, Universitas Padjadjaran.
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 reporting through a competent external consultant to obtain data series from 2009 to 2019.

6.2 Climate

The climate classification of the study area is based on rainfall data, according to Koppen classification system. The project area observes an ‘Af’ or tropical rain climate. This climate is characterized by high rainfall in the relatively long rainy. The Schmidth - Ferguson climate classification shows that the study location is in a type A climate, this is the same as the classification according to Koppen (Arifah, 2016).

Environmental climatic characteristics are compiled to describe the environmental climatic conditions of the project using the environmental parameters of rainfall, temperature and wind speed. Rainfall data is obtained from 7 rain stations around the study site, namely Cikundul, Cibalagung, Cisokan, Cimeta, Cirata, Jangari, Cipicung stations, while temperature data is obtained from Bandung geophysical station data, this is because temperature data are not recorded at stations around the study location. Rain station locations are shown on the map on Figure 24.

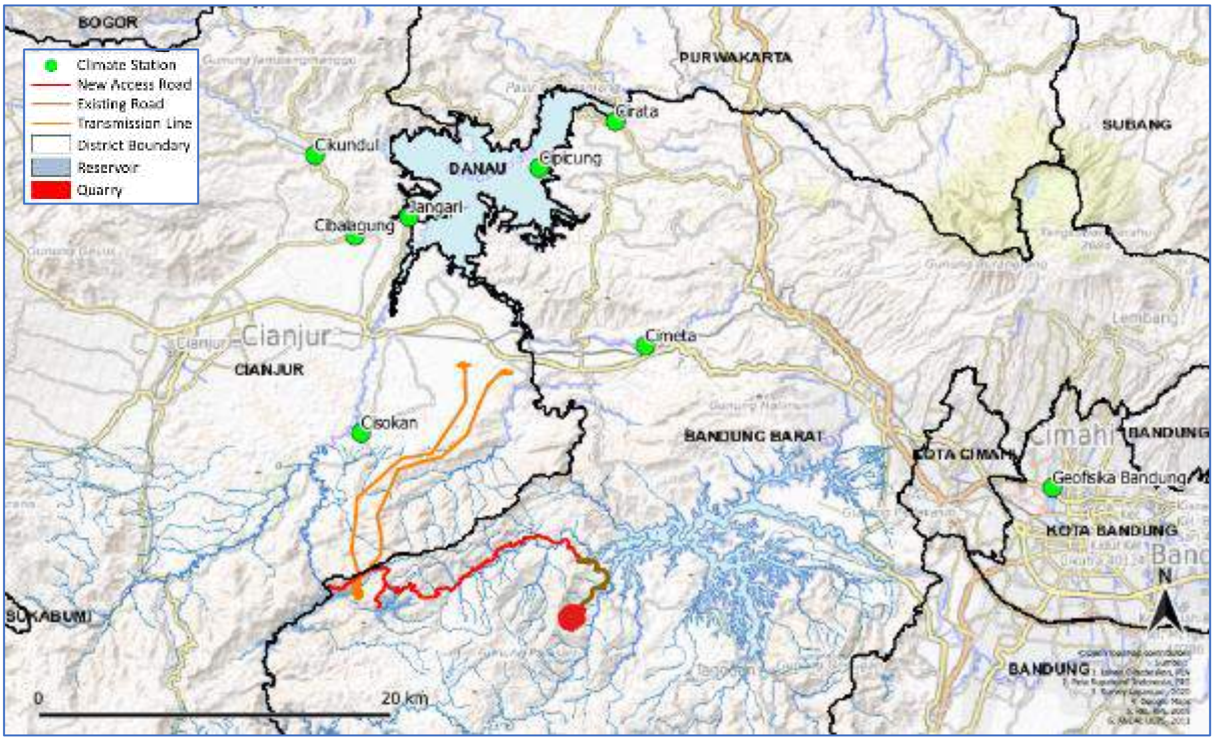


Figure 24. Location Map of Rain Stations and Bandung Geophysical Stations

6.2.1 Rainfall Characteristics

Annual rainfall distribution is obtained from rainfall data at 7 rain stations in the last 20 years (1999-2019. Analysis involves interpolation to obtain the spatial distribution pattern of rainfall characteristics using the isohyet method, then classification to obtain the annual rainfall distribution class. The results of the rainfall mapping show that, in general, the study location is an area with rainfall between 2240-2450 mm. The southern region is the upstream or catchment area of the Cisokan watershed. High rainfall will provide a high water supply for surface and groundwater. The distribution of annual rainfall in the study area is presented in Figure 25.

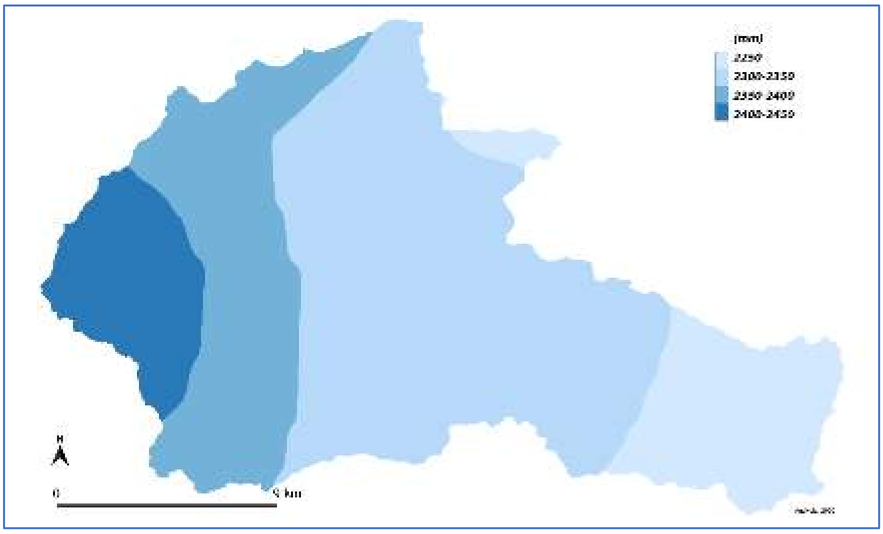


Figure 25. Rain Distribution in the Cisokan Watershed

6.2.2 Temperature Characteristics

Air temperature is an important parameter in environmental studies as it determines environmental conditions and conditions of land resources. Biotic and abiotic processes, including vegetation characteristics and vegetation growth, are also largely determined by temperature. Air temperature data were obtained from the Bandung geophysical station because the weather stations around UCPS did not record daily temperatures. The distance between UCPS and the Bandung observation station is about 30 km. The temperature distribution in the study area is shown in the Figure 26.

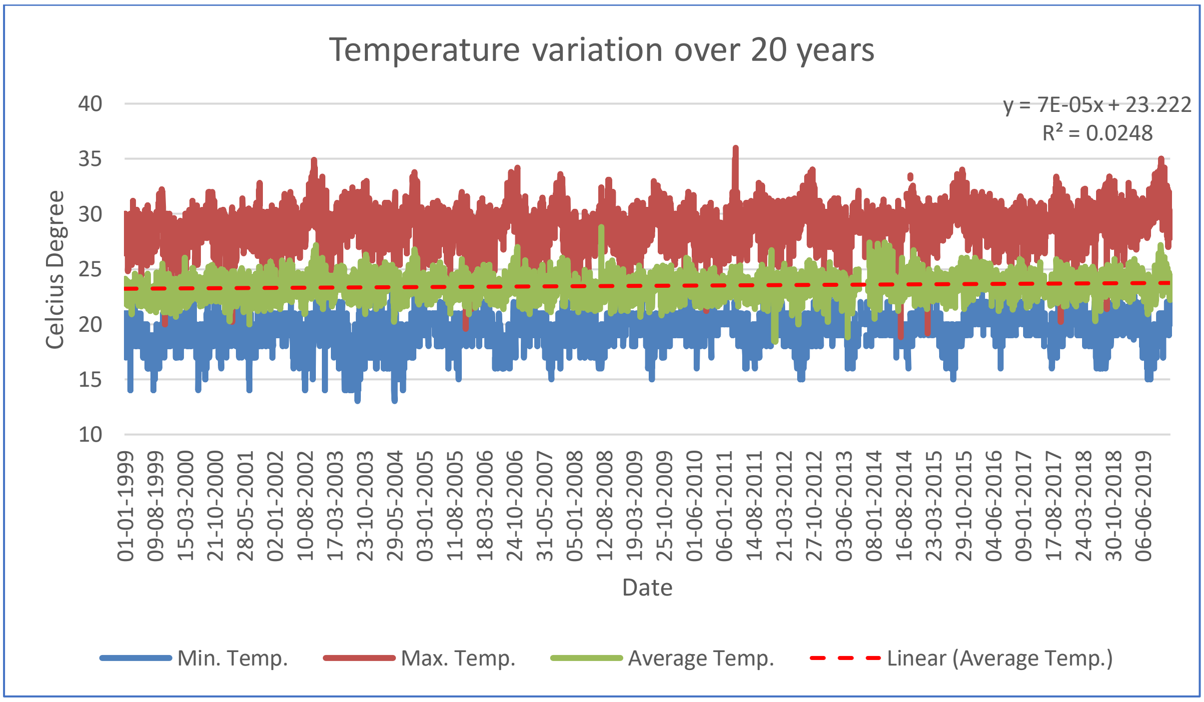


Figure 26 Average, minimum and maximum temperatures between 1999 and 2019, indicating a slight increase in mean temperature.

6.2.3 Wind Characteristics

Wind is the result of differences in pressure between places as a result of differences in temperature and humidity. The difference in pressure at both the local and global level causes air movement. Local wind movements include valley winds, mountain winds, land winds and sea breezes. The local wind movement is determined by the surface roughness characteristics or the topography of the area. Data on the movement of the wind direction in 2019, from the Bandung geophysical station, is displayed in the wind rose below.

Data for measuring wind direction and speed specific to the study location is only available from RKL-RPL measurements, which are carried out twice a year in April/May (semester 1) and September/October (semester 2). Only obtaining wind speed and direction data twice a year cannot accurately reflect the distribution of monthly directions and velocities, however, the month for taking wind direction and speed is related to the west and south-east monsoons (Figure 27). The results of wind direction measurements at the project site are almost the same as the wind direction measurement data at Bandung Geophysical Station. The results of measurements of wind direction and wind speed in the UCPS region are shown in Table 17.

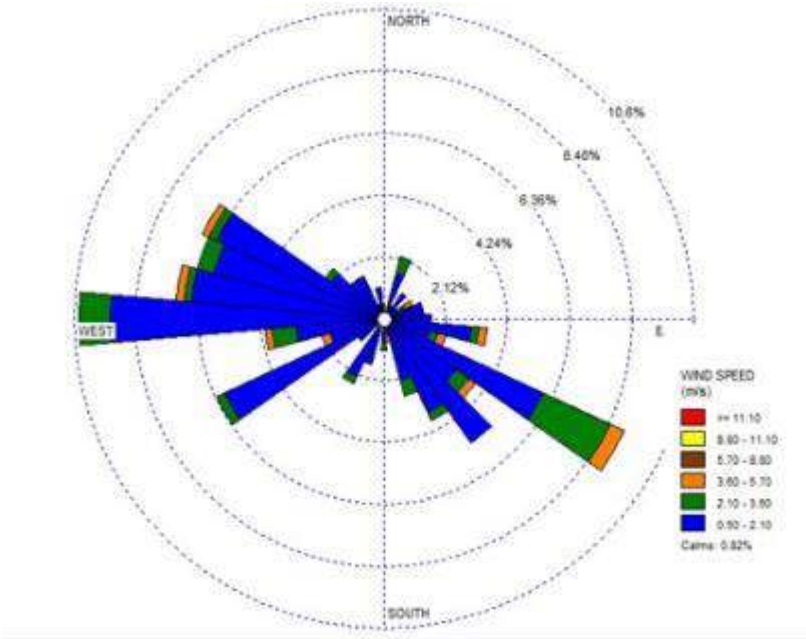


Figure 27. Wind Distribution in the Bandung Area, indicating predominant west-north-western and southeastern winds.

Table 17. Wind Speed and Direction of Monitoring Results in Study Area

No	Location	Parameters	Years													
			Mar-13	Apr-14	May-15	May-16	May-17	May-18	Apr-19	Oct-13	Oct-14	Sep-15	Oct-16	Oct-17	Oct-18	Oct-19
1	Quarry (Sarinagen Village)	Windspeed (m/s)	5,5	0,2	1,21	n/a	1,18	1,6	0.4-1.3	n/a	0.4-1.3	3,03	n/a	0,75	3,95	3,03
		Wind direction	E	W	W	n/a	E	E	W	n/a	W	W	n/a	E	W	E
2	Acess road(Al-Bargunnajah)	Windspeed (m/s)	n/a	n/a	n/a	0,69	1,15	1,18	n/a	0,63	n/a	n/a	0,63	1,37	3,2	1,62
		Wind direction	n/a	n/a	n/a	W	E	E	n/a	W	n/a	n/a	W	S	W	E
3	Acess Road (Cipari Junction)	Windspeed (m/s)	1,1	n/a	1,1	1,8	0,98	1,57	0.33-1.35	0,98	0.33-1.35	2,87	0,98	1,13	0,6	2,65
		Wind direction	S	n/a	W	W	S	E	W	W	W	W	W	S	W	SE
4	Access Road (Cijambu Village)	Windspeed (m/s)	1,3	1,1	n/a	n/a	n/a	n/a	0.33-1.35	n/a	0.33-1.35	n/a	n/a	n/a	n/a	n/a
		Wind direction	W	E	n/a	n/a	n/a	n/a	W	n/a	W	n/a	n/a	n/a	n/a	n/a
5	Upper Dam (Cibima Village)	Windspeed (m/s)	2,6	0,3	0,81	n/a	2,28	1,05	0.2 - 1.4	n/a	0.2 - 1.4	2,55	n/a	0,88	0,6	1,07
		Wind direction	S	W	W	n/a	W	E	E	n/a	E	W	n/a	W	W	E
6	Lower Dam (Sukaresmi Village)	Windspeed (m/s)	n/a	0,3	0,48	2,64	2,62	0,83	0.2 - 1.4	0,83	0.2 - 1.4	3,52	0,83	0,78	0,88	1,73
		Wind direction	n/a	E	W	W	W	E	E	W	E	E	W	W	W	E
7	Bojongsalam Village	Windspeed (m/s)	n/a	0,2	1,21	0,35	n/a	n/a	0.2 - 1.4	0,72	0.2 - 1.4	2,07	0,72	n/a	n/a	n/a
		Wind direction	n/a	S	W	W	n/a	n/a	E	W	E	W	W	n/a	n/a	n/a

(source: PLN, 2012a, 2012b, 2013a, 2013b, 2014a, 2014b, 2015a, 2015b, 2016a, 2016b, 2017a, 2017b, 2018a, 2018b, 2019b, 2019c).

6.2.4 Climate Change

Analysis of climate change is carried out by analyzing rainfall and temperature data over a prolonged time period. Climate change data in the study area were analyzed using data from 7 rain stations over 2 decades, namely 1999-2008 and 2009-2019. Climate change in the study area is identified by several climatic parameters, including: the trend of rainy days, rainfall, average rainfall patterns and trends of maximum and minimum temperature.

Based on the analysis of results of rain days trends, rainy days in the project area have a positive trend with an average magnitude of 48.52 mm. The 20 mm/day rain intensity can be seen from the trend equation in the graph, which has a slope value of 0.0422, meaning that rainy days with an intensity of 20 mm/day tend to increase by 0.0422 days every year, or about 0.5 days per decade (Figure 28).

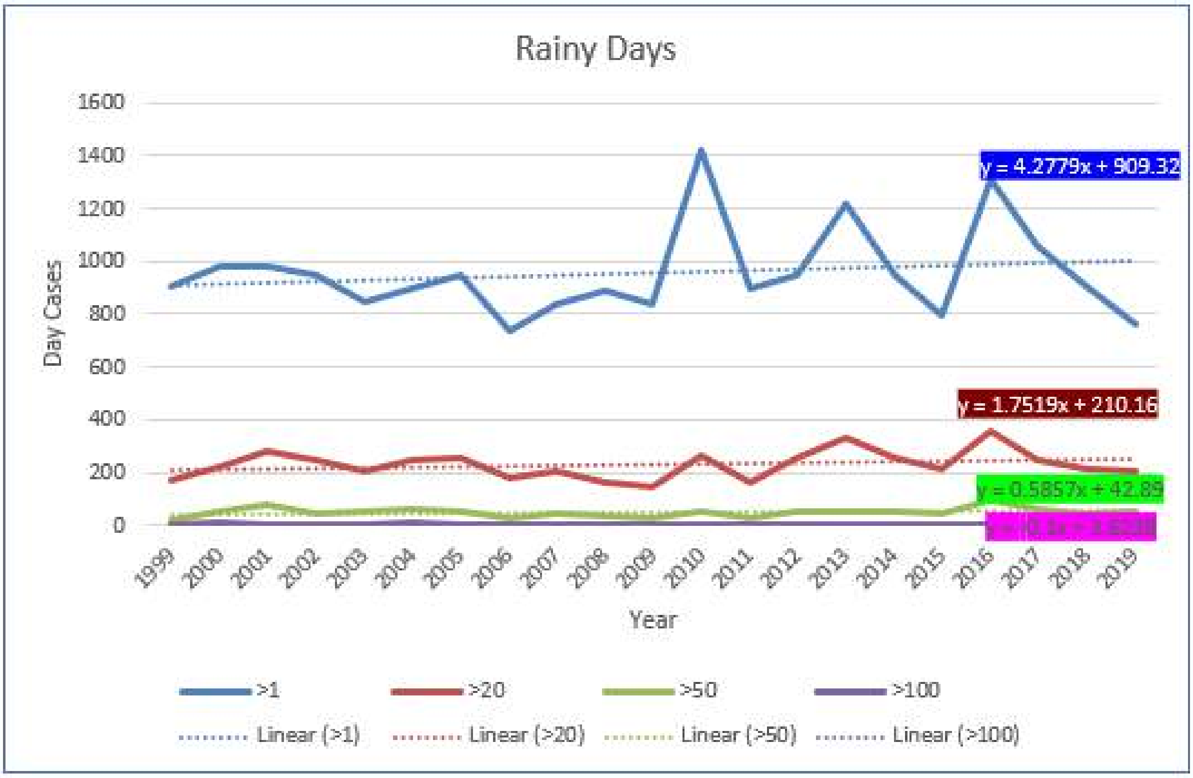


Figure 28. Number of Rainy Days in Various Rain Intensity Categories

The annual rainfall trend shows an increase in the average amount of annual rainfall at various stations in the study area. Cisokan Station, which is closest to the study location, shows the highest increase in annual rainfall, reaching 400 mm in the last ten years (Figure 29). Increased rainfall is an indication of climate change in the study area.

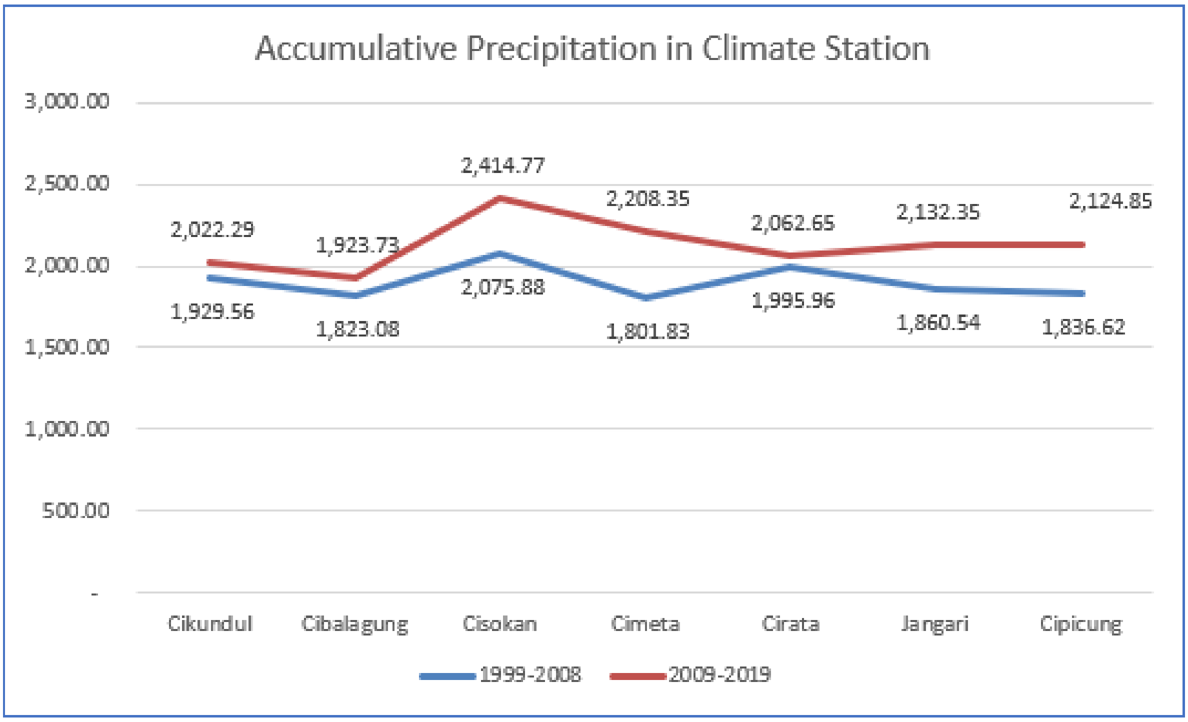


Figure 29. Changes in the Amount of Annual Rainfall for Each Decade at Various Weather Stations

Based on changes in the normal pattern of rainfall, it is known that there has been a change in the pattern of rainfall in the last 10 years in Indonesia. The peak rainfall is higher than the 10-year trend, followed by a dry season and a sudden wet season, marked by a sloping pattern in the dry month that narrows in the following chart (Figure 30).

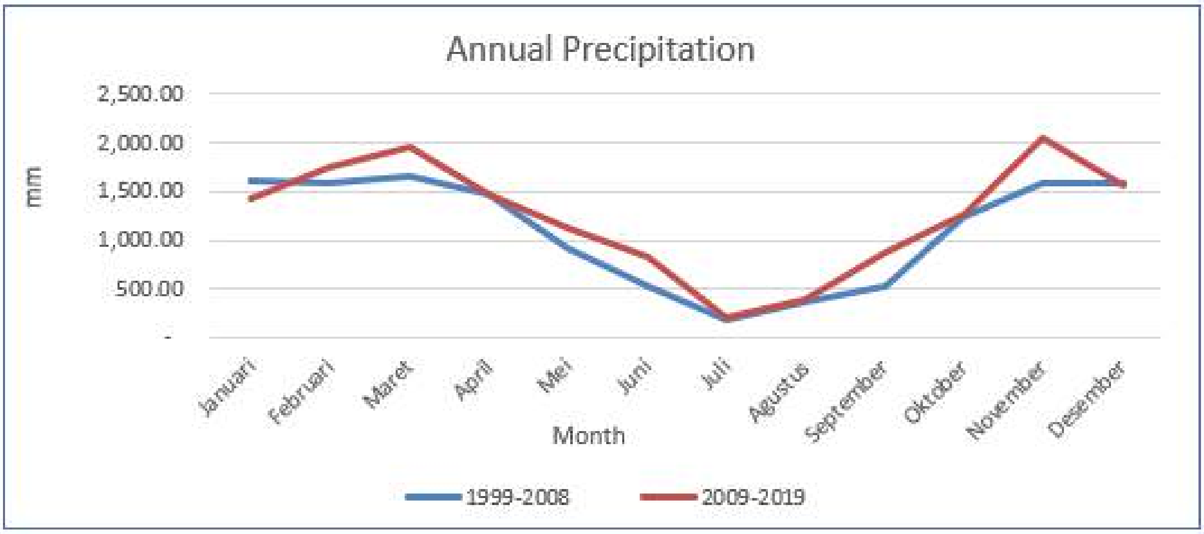


Figure 30. Change in Average Rainfall Pattern for Each Decade in the Study Area

Based on the results of the processing of temperature trends in Bandung and its surroundings, the temperature in Indonesia, both minimum, average, and maximum temperatures, have an average positive increase of 0.01 °C each year (Figure 31). This means that the temperature will increase 0.01 °C each year so that within 30 years the location will increase by 0.3 °C.

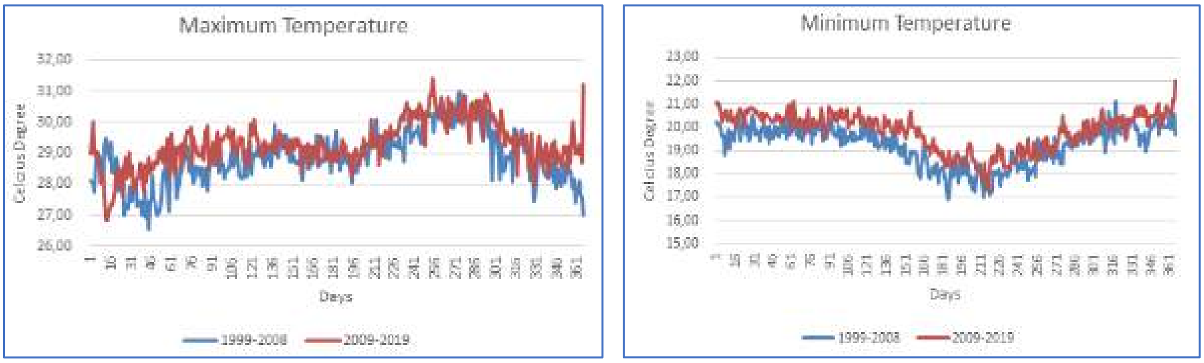


Figure 31. Comparison of Average Minimum and Maximum Temperature

Future climate predictions are obtained from analysis of temperature and rainfall using serial data. This data is presented in the form of a map of changes in the normal/average composite mean of the two periods compared for climatic parameters related to rainfall and temperature. The periods being compared are the current period (2006-2014) and the near-future period (2032-2040) (BMKG, 2020).

The projection results of changes in seasonal rainfall for the period 2032-2040, against the 2006-2014 period in Java Island, show that the projected change in seasonal rainfall for the period 2032-2040 at UCPS locations will decrease with changes between 0-20% (Figure 32). Further south the change in seasonal rainfall increases from mild to severe.

Changes in seasonal rainfall can also provide information about climate change. Changes in seasonal rainfall provide information on the increase or decrease in rainfall which will have an impact on natural water resources.

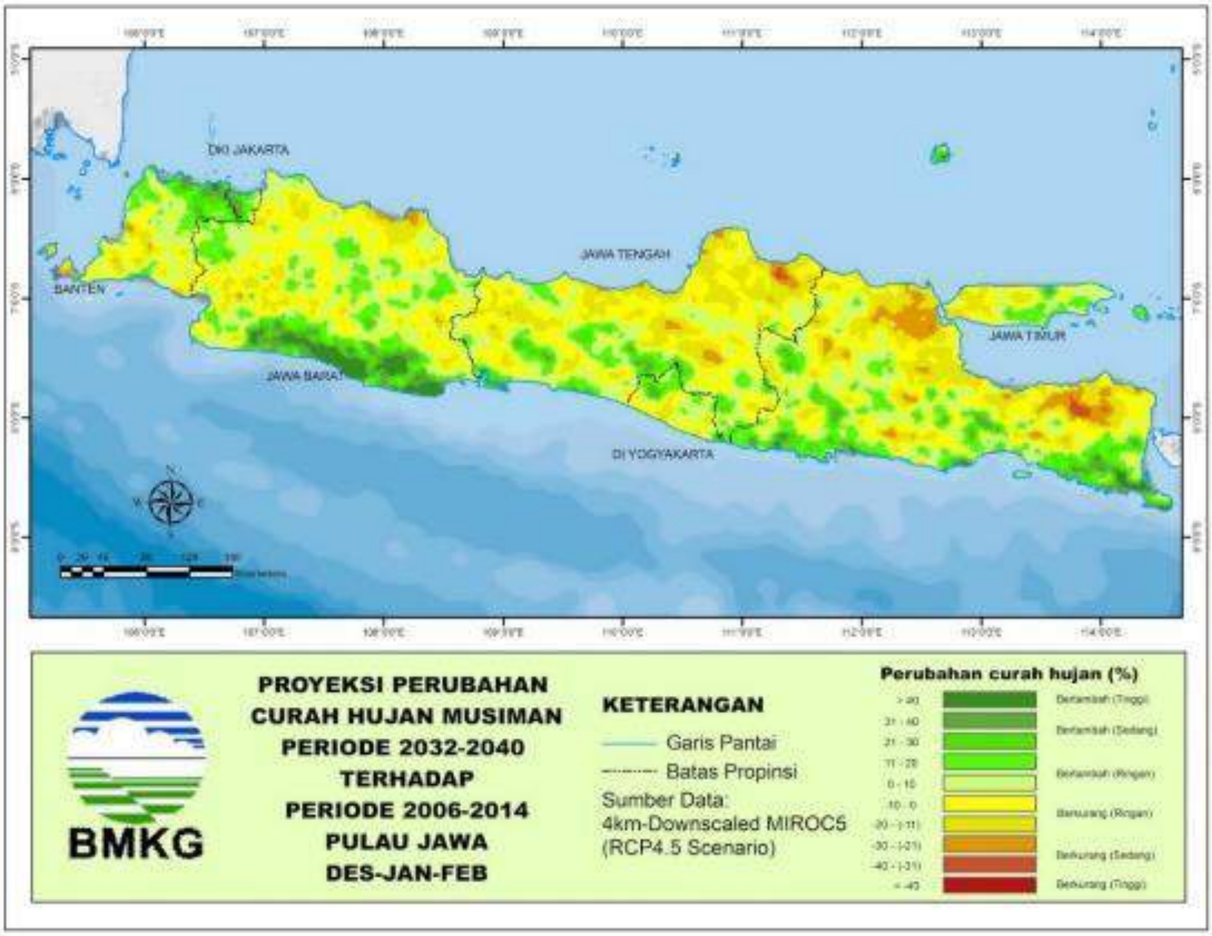


Figure 32. Seasonal Rainfall Changes Projection in Java Island

The results of the analysis of changes in seasonal rainfall show that seasonal rainfall has increased in the southern part of West Java, while the central and northern parts of West Java observe no change or a slight decrease. The UCPS location shows the potential for a mild decrease in seasonal rainfall.

The results of the analysis of the increase in the frequency of rain show that the UCPS location observes a slight increase in the frequency of heavy rain. Southern Java tends to experience an increase in the frequency of light rain, while northern Java tends to experience a decrease in the frequency of heavy rain.

Judging from the distribution of additional days without rain in West Java, it is more dominant in the central part to the north, with a greater percentage when compared to the decrease in the number of days without rain. The decline in the number of days without rain was dominant in the southern and eastern parts of West Java. The UCPS change of days without rain leads to more days without rain by a relatively small number.

Based on the results of the Consecutive Dry Days (CDD) analysis, which is one of the climate change indices recommended by the Expert Team on Climate Change Detection and Indices (ETCCDI), it is known that the areas of Java Island that show a fairly extensive increase in CDD are West Java and North Central Java. The increase in CDD shows an indication that the dry season is getting longer so that the potential for drought is getting higher. The UCPS location shows that the CDD value has increased considerably with medium-high class. This condition will have an impact on the water supply to the reservoir in the dry season. The longer the dry season, the lower the water supply, so it is necessary to manage water for generating operations and irrigation water for lower areas.

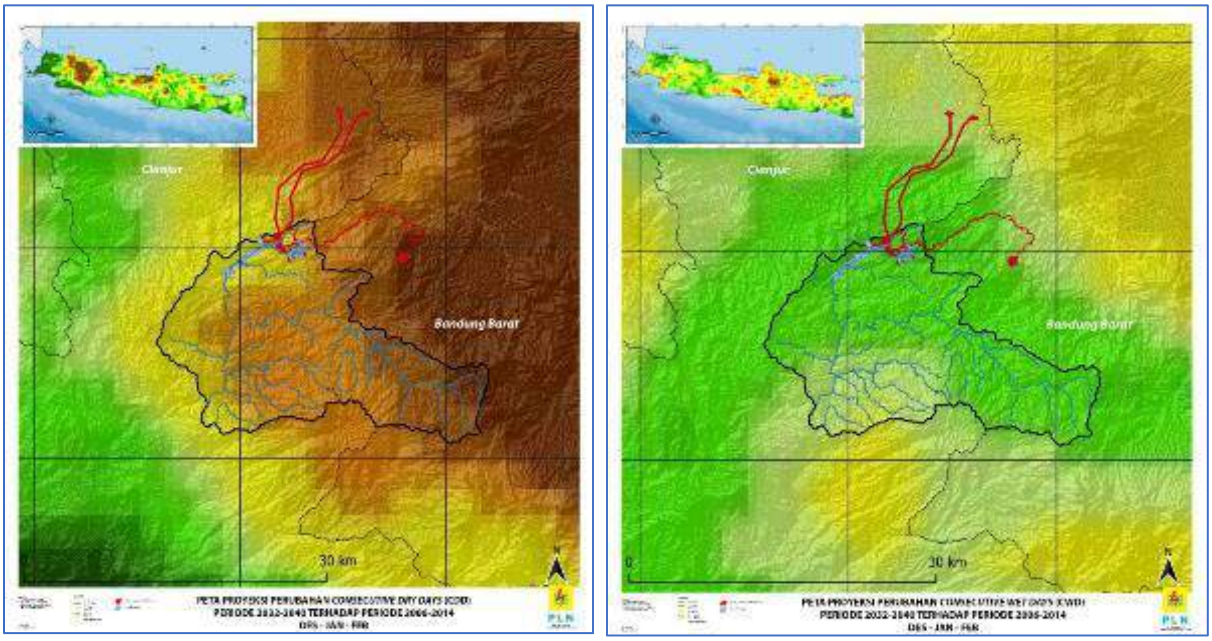


Figure 33. Projections of Change in CCD and CWD for the Period 2023-2040 in Java Island

Meanwhile, the results of the Consecutive Wet Days (CWD) analysis around Bandung tend to be shorter in the south and west, while the eastern part of Bandung tends to be longer. The UCPS location shows a shorter trend in the Cianjut direction, indicating a tendency for longer consecutive rainy days. This shows that consecutive rainfalls have a shorter duration, so that it will have an impact on the amount of water received by the watershed. The projected map of changes in Consecutive Dry Days (CDD) and (CWD) changes for the 2023-2040 period obtained from BMKG is shown in Figure 33.

The results of the heavy rain fraction analysis showed that the UCPS location had a tendency for the heavy rain fraction to decrease, while the Bandung basin area showed an increase in the fraction of heavy rain. The fraction of heavy rain at the UCPS location is projected to decrease, giving an impact on peak discharge events, namely the potential for peak discharge that occurs has the potential to decrease.

The determining factor of climate change, besides rainfall, is air temperature. The results of air temperature analysis can be used to predict future changes in temperature. In general, the results of the temperature analysis show that there has been an increase in air temperature from 2006-2014. The results of the 2006-2014 temperature analysis are used as the basis for making temperature prediction models in the coming period, in this case the temperature predictions for the year 2032-2040. The prediction models produced to describe the temperature information in the coming year are; changes in average temperature, changes in mean maximum temperature, changes in mean minimum temperature, changes in daily temperature. Climate change is indicated by an increase in surface temperature, this can be illustrated by several of these parameters. The distribution of changes in average temperature in Java is presented in Figure 34.

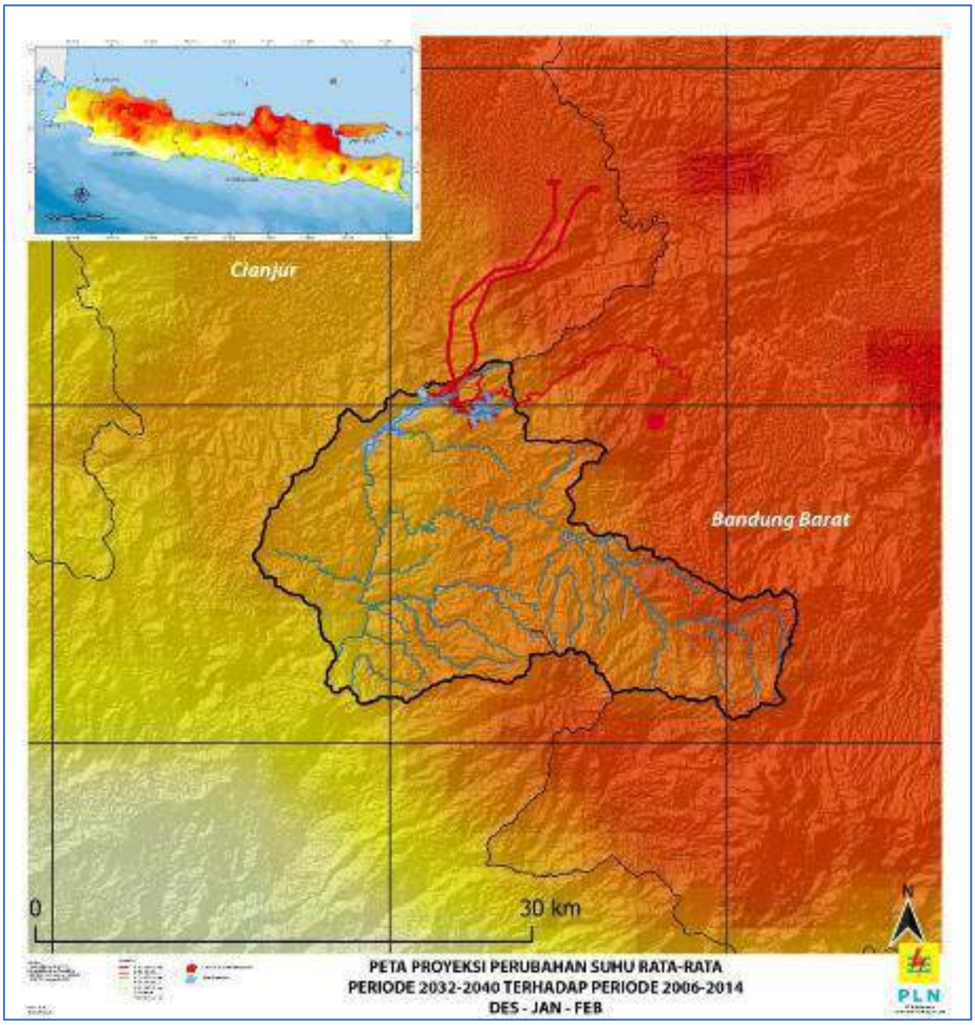


Figure 34. Projections of Changes in Average Temperature for the Period 2032-2040 in Java Island

The results of the average temperature prediction analysis show that almost all areas in Java Island show an increase in average temperature to varying degrees. The southern part of Java Island has a relatively small increasing trend when compared to the northern part of Java Island. The average temperature increase at the UCPS site was in the medium-high category with a range of more than 0.8◦C.

6.3 Topography

Based on the topographic map of the Cisokan watershed, the project area is located in a vulnerable mountainous area in the southern part of West Java. Topographic height ranges from 270.41 m to 2,075 m above sea level. The northern part of the region is the alluvial plain and the Indian Ocean in the south. Within the wider landscape, there are volcanoes and alluvial plains, including Mount Pangrango to the Northeast of the project site.

Among the topographical landscape of the Cisokan watershed, it can be seen that the Cisokan River flows from South to North. The Cisokan River is one of the Citarum tributaries. The 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 flowing into the plains, where it joins the Cirata Dam.

The topography of the UCPS project site consists of gently-sloping to steep hills with an altitude between 400-1000 m above sea level. Topographic conditions in the Cisokan watershed are shown spatially in Figure 35.

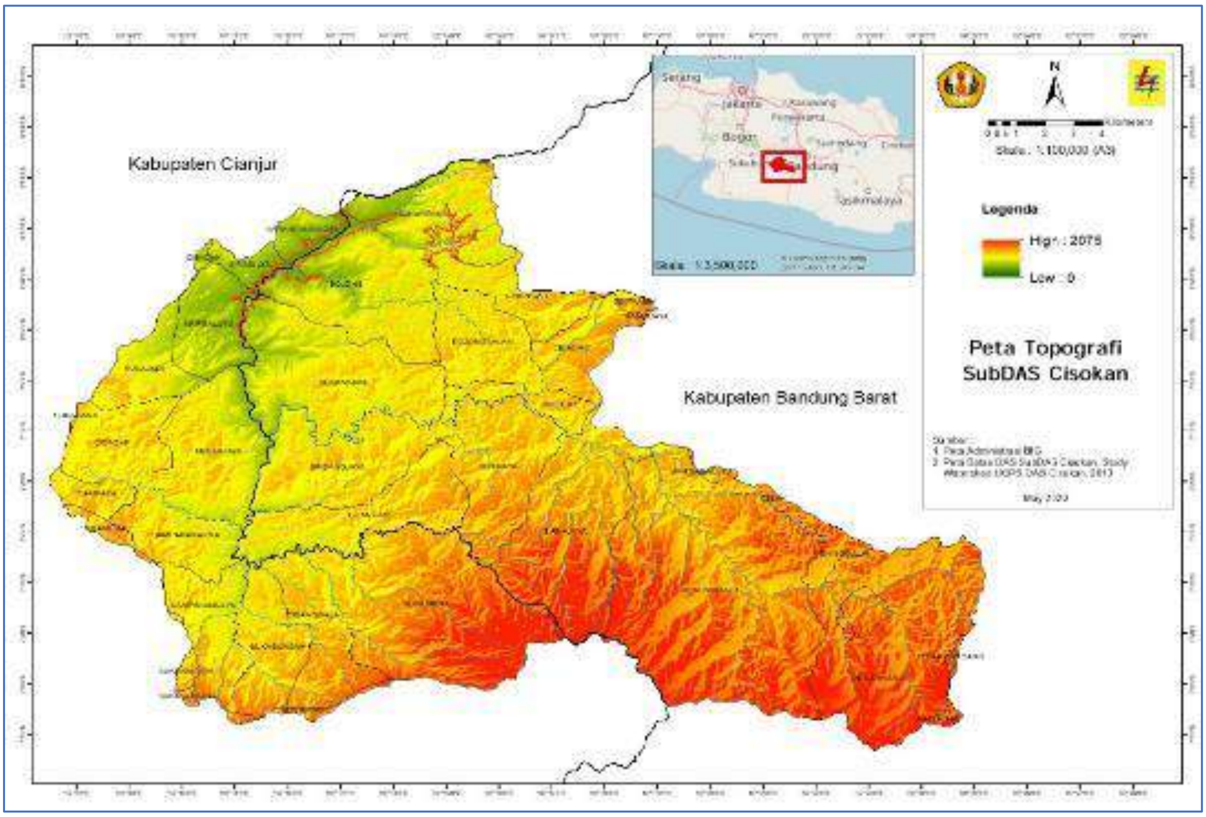


Figure 35. Topographic Map of the Cisokan Watershed

In general, the study area is formed by a degradation process that forms denudational mountains. The landscape of the project area consists of tertiary volcanic and sedimentary rock, with the geological structure of folds and faults that generally point to the northeast - southwest direction.

Based on the classification that has been carried out, it is known that the area in the Cisokan watershed, which has a slope <8 (flat), is 4,768.78 Ha, the area with a slope of 8% - 15% (gentle) is 10,365.57 ha, the area with slope of 16% - 25% (Slope) is 14,751.55 ha, the area with a slope of 26% - 40% (very sloping) is 7,264.07 ha, and the area with a slope of> 40% (steep) is to 291.68 ha. The spatial distribution of slopes in the immediate project area is shown in Figure 36.

The spatial distribution of the slope from the digital modeling results shows that the locations with high slopes are in the north and south. The northern, downstream area is the planned area for the lower Cisokan weir and the upper Cisokan. The position of the dam is very suitable because it is on a steep slope, allowing the weir body to be relatively short. The upstream, southern region is a protected forest area, so it is very suitable for the land capability. Areas with high land slopes usually have low soil solum depth due to high erosion, but maintaining forest cover on the steep land reduces erosion potential.

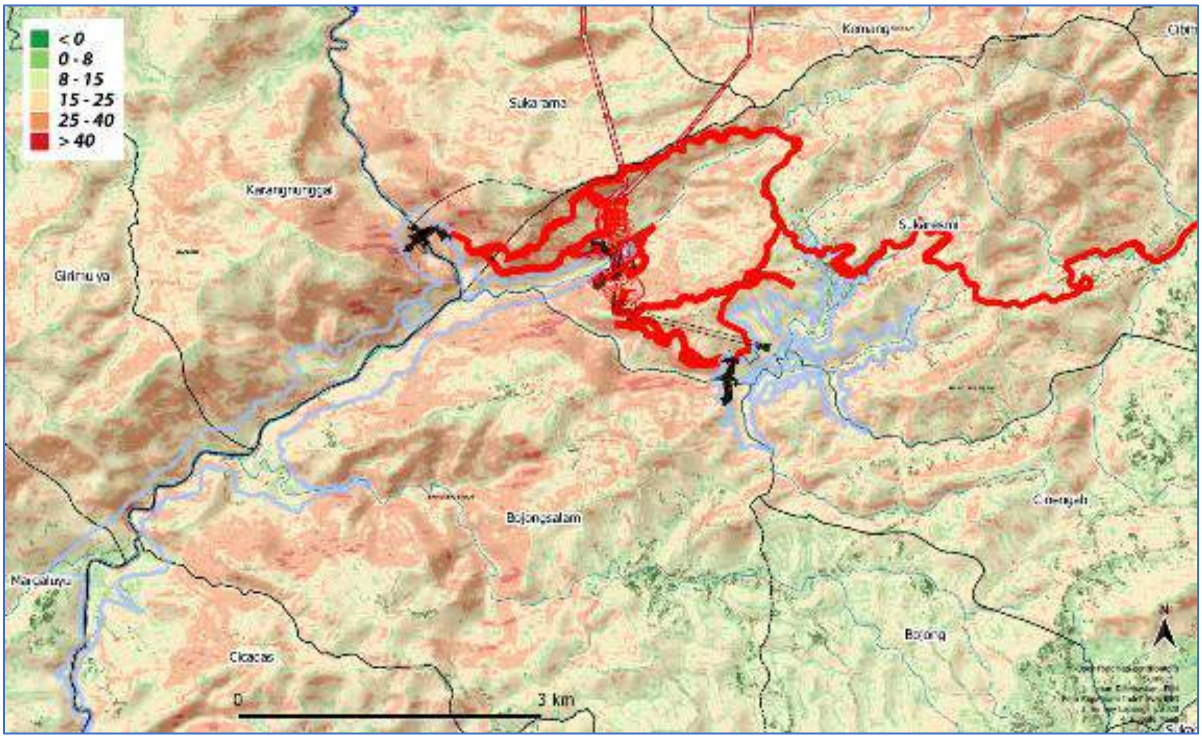


Figure 36. Slope Map in UCPS

6.4 Geology

The Bandung Zone is a volcanic area that is relatively depressed when compared to the Bogor Zone and the Southern Mountain Zone. This zone forms a depression, but its 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 weathering of Tertiary rock and Quaternary volcanic deposits, so that most of it is filled with alluvial and Quaternary volcanic deposits.

The geology of the UCPS Cisokan location (upper weir and lower weir) is taken from the Geological Map of the Sheet Cianjur (Sudjatmiko, 2013) with a scale of 1:100,000. Based on the map, it is known that there are 3 rock formations that underlay the project location, namely, the Rajamandala Formation (Omc), the Citarum Formation (Mts), and the Pb Formation (Pb) (Table 18, Figure 37).

Table 18. Geological Formation in the Project area

Age	Abbreviation	Formation Name	Main Appearance
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

The three (3) supporting geological formations at the UCPS Cisokan project site are as follows:

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

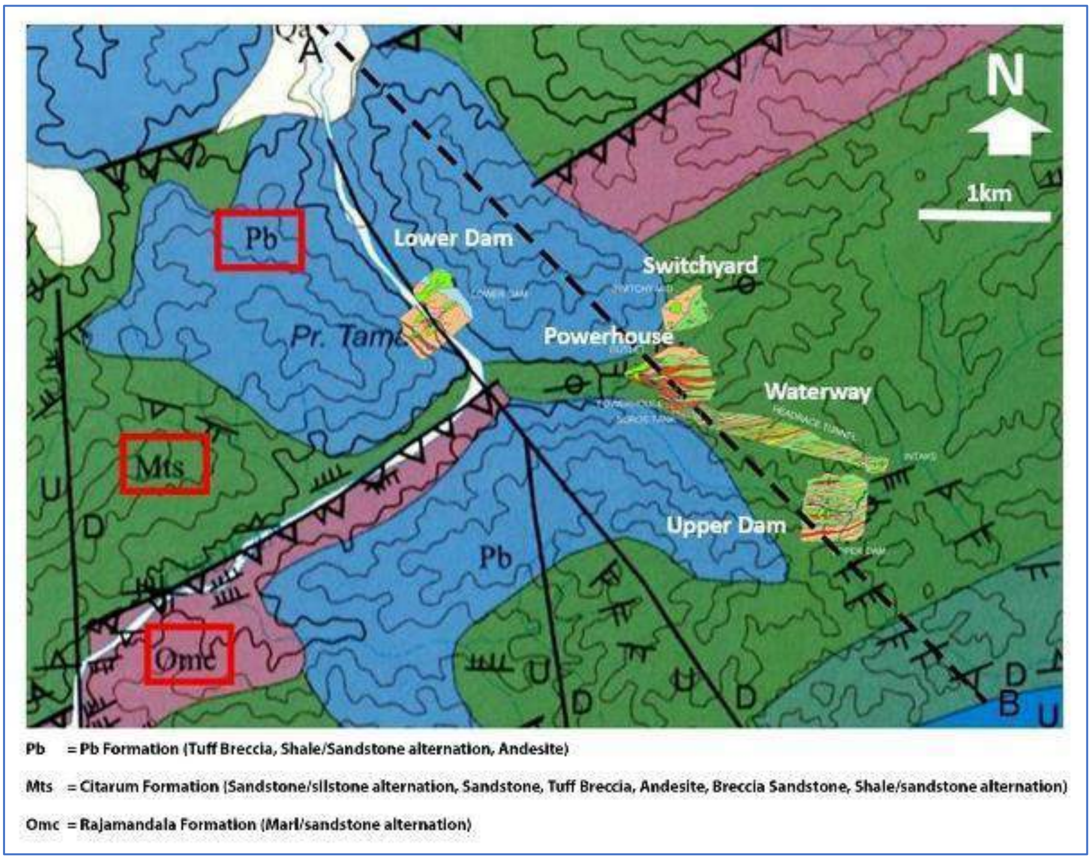


Figure 37. Geological Map of the UCPS Cisokan Area enlarged from the Geological Map of Cianjur

The **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 have formed during the early miocene of the tertiary period.

The Citarum Formation is the most extensive rock formation at the UCPS Cisokan project site. Some of the buildings that will be built on top of this formation are the Upper dam, waterway and powerhouse. In several places, drag faults have been observed, which characterize that this area is intensively tectonic. There are several types of sandstones observed in the study area, namely dark blue sandstones and brown sandstones. Sandstones that are bluish dark in color are generally tougher, while sandstones that are weathered brown are more intensive. The result is sandstones that are dark in color generally have thin soil, while sandstones with brown soil tend to be thicker.

The **Pb formation** (Pb). The Pb (Pb) formation relies on the Rajamandala (Omc) formation and the Citarum (Mts) formation with discrepancies. The Pb (Pb) formation is mostly distributed in the northern and southern regions of the Omc and Mts distribution. The Pb (Pb) formation consists of Tuff Breccia (Br), Shale / Sandstone (Sh / Ss), and Andesite (An). The Pb Formation is thought to have formed in the Pliocene Tertiary Period. The buildings that will be built on the Pb formation are the Lower dam. In detail, the geological distribution of the location of the Cisokan UCPS area is presented in Figure 37.

6.5 Land Use and Land Cover

6.5.1 Land Use in the Cisokan Watershed

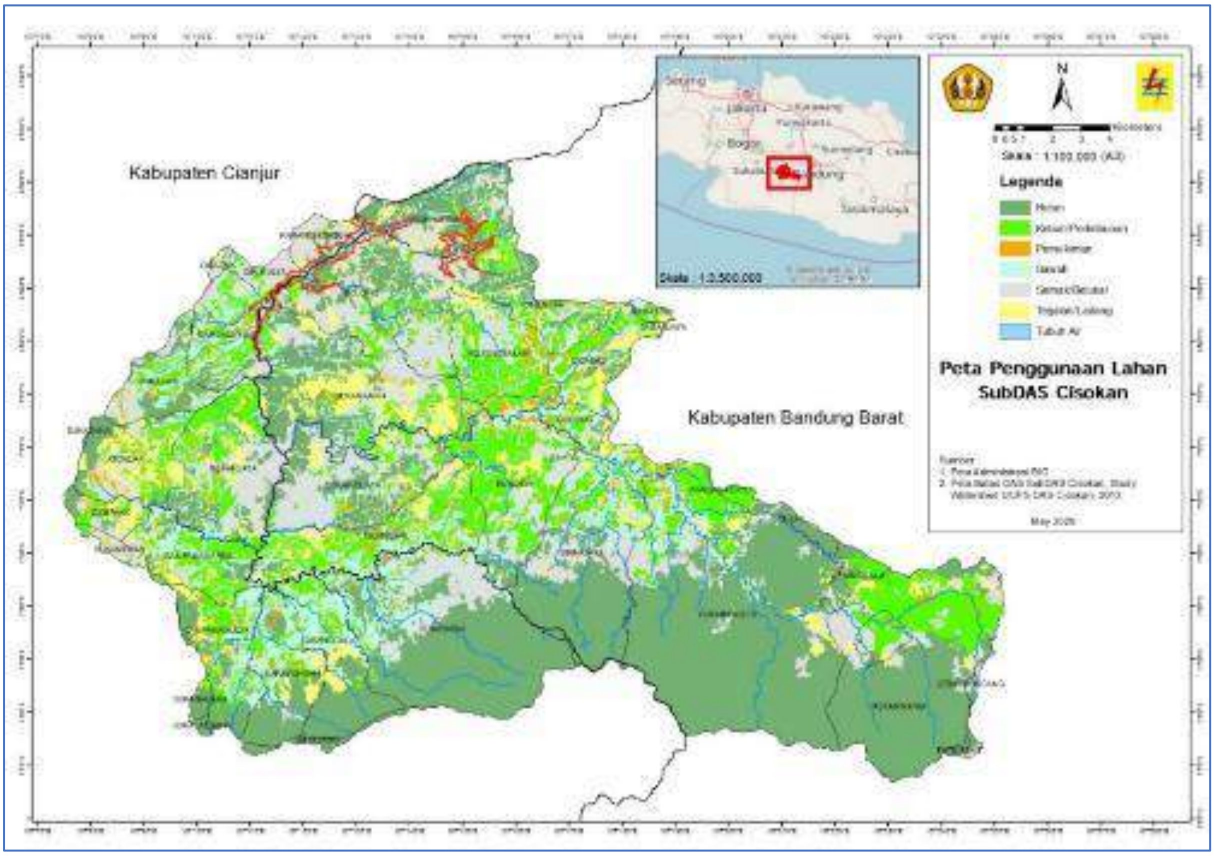


Figure 38. Land Use Map in the UCPS Cisokan Watershed in 2020

Land use in the Cisokan watershed consists of forests, gardens, settlements, rice fields, shrubs, fields and water bodies. The results of land use mapping in 2020, as a data updating activity, using visual interpretation of 2020 satellite imagery, shows that forest land area is 14,918.34 ha (40%), plantations 5,993.09 ha (16%), settlement 1,283.48 ha (3%), paddy fields 6,120.67 ha (16%), thickets 5,857.36 ha (16%), fields 3,033.84 ha (8%), and water bodies 222.65 ha (1%). The land use map is shown in Figure 38.

6.5.2 Transmission Line Land Use

Updating of land use in the UCPS transmission line was carried out using visual interpretation of 2020 image data. Mapping results show that land use in the transmission line consists of forest land area of 2,201.79 ha (24.21%), secondary forest 2,813.44 ha (30.94%), shrubs 275.89 ha (3.03%), fields 302.21ha (3.32%), rice fields 2,845.95 ha (31.30%), settlements 591.22 ha

(6.50%), open land 41.85% (0.46), and water 221.04 ha (0.23%). The land use map of the transmission line is shown in Figure 39.

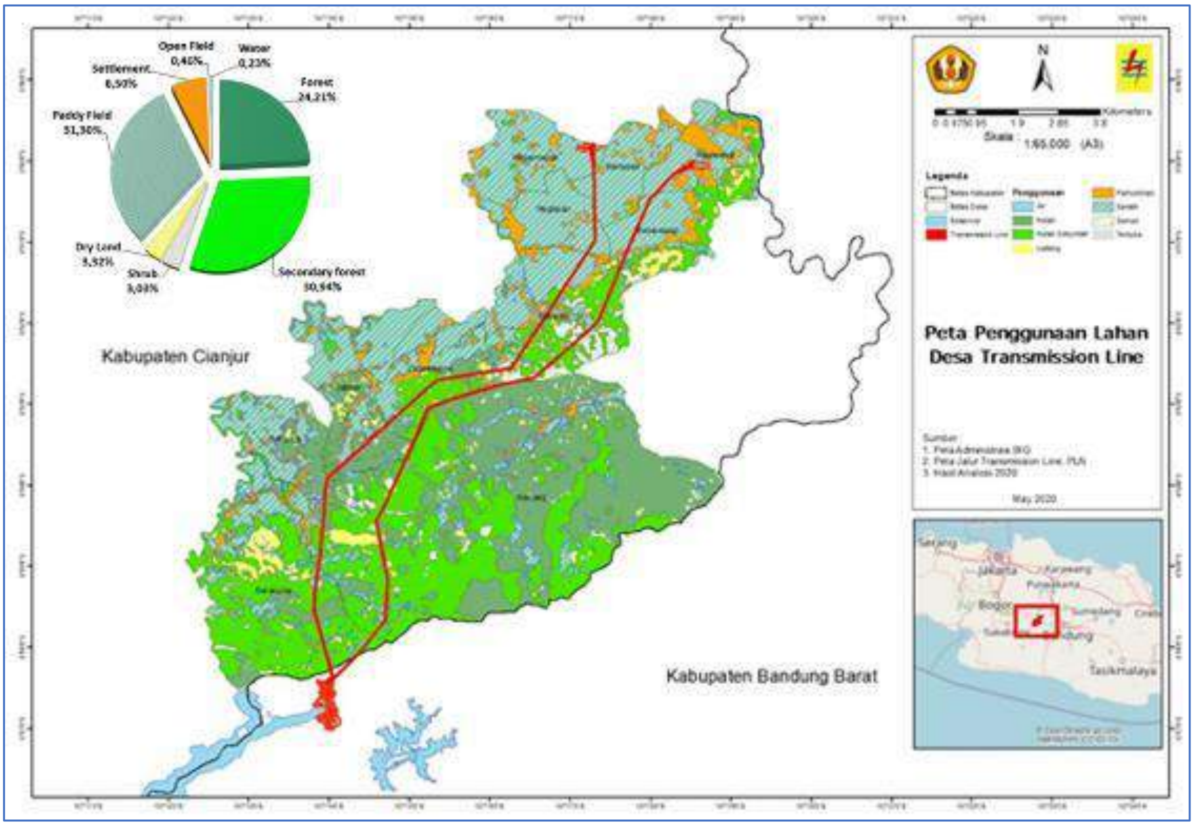


Figure 39. Land Use on the Transmission Line

6.5.3 Land Use at the UCPS Project Site

The delineation of the main vegetation types in Cisokan is guided by the results of biodiversity research conducted by the Indonesian Institute for Sciences (LIPI) in 2012, as well as earlier studies by Ade Rahmat in 2009, and the ANDAL UCPS hydropower study in 2007, with the results of the analysis of RapidEye imagery maps 2011–2012. The resulting analysis identified several ecosystem types (or vegetation communities), including natural degraded forest, production forest (with stands of pine, teak, or *Altingia excelsa*), areas of mixed gardens or agroforestry (locally named *talun*), scrub areas, slash and burn cultivation areas that make up agricultural fields on slopes, rice fields in flat areas, and fish ponds, settlements and yards. The land use map created for the 2020 update is shown below in Figure 40.

6.5.3.1 Natural Degraded Forest

Natural degraded or secondary forest is a combination of native and non-native shrub and tree species that have grown back after land clearing, see Figure 41. Throughout the area, this vegetation can be found in fragments, usually in more steep areas where agriculture or forest cannot grow. This area includes inaccessible cliffs and riverbanks in hillside gaps, and is found along the Cirumamis River between the upper and lower reservoir areas.

LIPI (2012) and Rahmat (2009) recorded at least 376 species of plants belonging to 268 genera and 160 orders in the area of natural forest in UCPS hydropower project site and surrounding areas. From the 160 orders recorded, the dominant orders that make up the forest community include Euphorbiaceae (22 species), Moraceae (21 species), Meliaceae (15 types), and Fabaceae (23 species). These areas generally have the highest biodiversity.

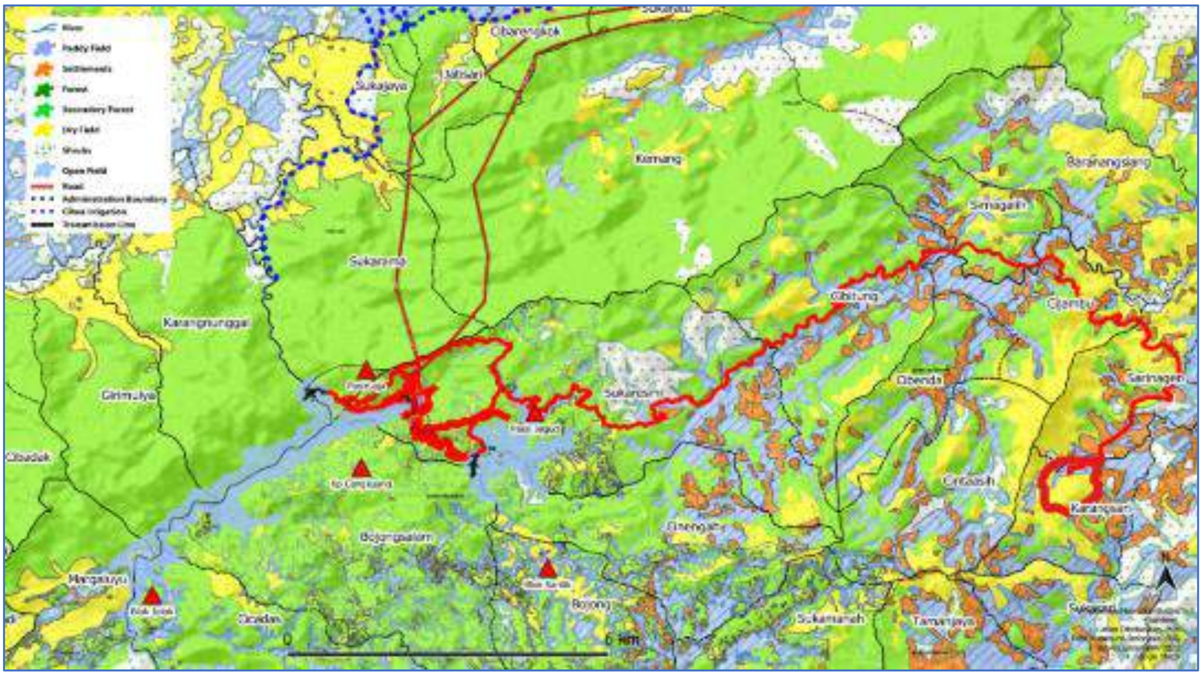


Figure 40. Land Use Map at the UCPS Project Site

Figure 41. Secondary Natural Forest in the Lower UCPS Watershed Area, with Cirug Walet waterfall in the background

6.5.3.2 Production forest

The state production forest (see Figure 42) in the area around the project is managed by the state forestry company on Java (Perhutani) and is dominated by pine and mahogany trees, with grassy ground cover. The production forest in the area around the project is a habitat for some wildlife. Local people take advantage of pine trees for their sap.

Figure 42. Poorly maintained Production Forest in the Study Area with pine

6.5.3.3 Mixed garden / Talun / Agroforestry

Mixed garden is a land use type found between agricultural fields and plantations and forests. This type of land use serves to support food needs and provide additional income for local communities. Types of commodities grown include food crops, coffee, bananas, avocados, coconuts, bamboo and sugar palm. The mixed garden in the area around the project covers a large hilly area. Mixed gardens, locally known as *talun*, are still good habitats for local fauna because of the forest canopy structure, the diversity of species from native and deliberately planted species and a large enough level of vegetation to cover the land cover. This system is also known as community forest and encompasses a variety of crops and plants. Some of the dominant plant species in this ecosystem types are sugar palm (*Arenga pinnata*), timber species such as *Albizia falcataria*, *Parasserianthe* ssp, and mahogany (*Swietenia* sp.), as well as a range of fruit trees for human consumption, including soursop (*Annona muricata*), menteng (*Bacaurea racemosa*), rambutan (*Nephelium lappaceum*), and mango (*Mangifera indica*). Some of the plant species here have high economic value such as durian (*Durio zibethinus*) and petai (*Parkia speciosa*). These areas can be quite valuable for biodiversity, depending on species composition, size of the area, and also other threats such as hunting.

Figure 43. Agroforestry and rice cultivation in the Study Area

6.5.3.4 Scrub and Upland Vegetation

These ecosystem types can be found along the Cirumamis River, Cilengkong River and on the east side of the Cisokan River, especially on slopes. Although the status of these areas is in many cases protected production forest, the areas are quite degraded because of illegal timber extraction, collection of grass for animal feed and other resource extraction. This is also evident in the production forests to the west of the Cisokan River where communities have trees such as *Albizia falcataria*, teak (*Tectona grandis*) and calliandra (*Calliandra calothyrsus*).

Figure 44. Shifting agriculture in shrubland areas

Local communities also utilize these upland scrub areas and fields for slash and burn cultivation (Figure 44), often using annual crops for cultivation under stands of trees that had been planted earlier. These cultivated land systems contain lemongrass (*Andropogon citratus*), mixed with reed plants (*Imperata cylindrica*) and other grass species.

6.5.3.5 Settlements, agriculture and gardens

Areas around houses are generally planted with various types of plants with economic or aesthetic value. These are generally small areas of vegetation measuring less than 150 m^2. Types of plants commonly found in settlement yards include banana (Musa paradisiaca), coffee (*Coffea* spp.), jackfruit (*Artocarpus heterophylla*), African Umbrella Tree (*Maesopsis eminii*), clove (*Eugeuna aromatica*), avocado (*Persea americana*) and bamboo (*Bambusa* spp.).

Fish pools are used to grow fish such as tilapia (*Thylapia mozambica*). Fishponds are generally found in areas of land by the river where natural springs emerge. In addition to aquaculture, fishponds are alternately used for growing rice (Figure 45). Generally, rice is grown in wet paddy systems using high-yielding varieties, allowing 2 to 3 harvests per year. Surveys suggested that these environments are poor in native wildlife species.

Figure 45. Rice Fields and Fish Ponds in the Study Area

Most of the rural communities in the hilly areas around the project site do not have house yards because most residents cultivate directly in the rice fields and gardens. Most of the use of yard land is in the quarry location. Utilization is used for planting ornamental plants, fruit trees and vegetable gardens (such as tomatoes and chilies), gardens and fish ponds.

Figure 46. Settlement in upper dam area with village gardens of coconut and other species

6.5.4 Land Use Land Cover Change

Land use/ land cover change at several locations in the project area can be analyzed using satellite imagery. Monitoring Google satellite imagery data from 2013 to 2020 indicates local changes in land use from secondary forest or shrubs to agricultural land (Figure 47). changes in land use also occur in changes in land cover to access roads. Satellite imagery for 2020 shows an avalanche on the slope above Curug Walet (red circle in the picture

Figure 47. Examples of changes in land use around Walet Waterfall in 2013 - 2017 – 2020

Secondary forest may be avoided from further land clearing processes because it is steep, although logging and timber extraction are still sometimes carried out. Forest fires are a risk.

Fauna is at risk of being isolated from its population and the carrying capacity of fragmented forests is limited. This was confirmed from observations in the field, that there was an avalanche of about 30 meters close to the location of Curug Walet (Figure 48). Steep slope topography and agricultural activities have triggered landslides on the slopes around the study area (Figure 48).

Figure 48. Confirmation of land cover change in the Study Area

In 2020 the access road from the Cipari Junction to the Upper and Lower Dam has been completed. With the access road, currently new settlements have appeared on the right and left of the access road (Figure 49). This shows a change in land use around the UCPS location, especially on the access road. The appearance of new settlements has been confirmed to have occurred in locations around UCPS as shown below.

Figure 49. The appearance of new settlements on road access

Lembur Sawah Hamlet is a settlement located above the switchyard development plan at the UCPS project. In 2020, relocation at Lembur Sawah Hamlet has been implemented as shown by the red circle Figure 50 below. Several settlements are seen moving out of the switchyard construction area in the period between 2013 and 2020.

The satellite imagery shows that the construction of the access road has been completed up to the location of the Lower Dam (Figure 51). It can be seen on the left of the figure, that from 2013 to 2020, agricultural activities by slash and burn were still found on agricultural lands around the project area. The area around the Gowek Forest which has dense land cover with a slope of> 40% and a range of wildlife species, such as the Javan Leopard and Pangolin

(Husodo et al., 2019; Shanida et al., 2018; Withaningsih et al., 2018), apparently did not experience significant changes in land cover from 2013 to 2020. However, agricultural activities continued elsewhere and it is necessary to carry out good management in the area, related to the area directly adjacent to the habitat wildlife in the Gowek Forest area.

Figure 50. Location of Lembur Sawah Hamlet, Sukaresmi Village (a) 2013 and (b) 2020.

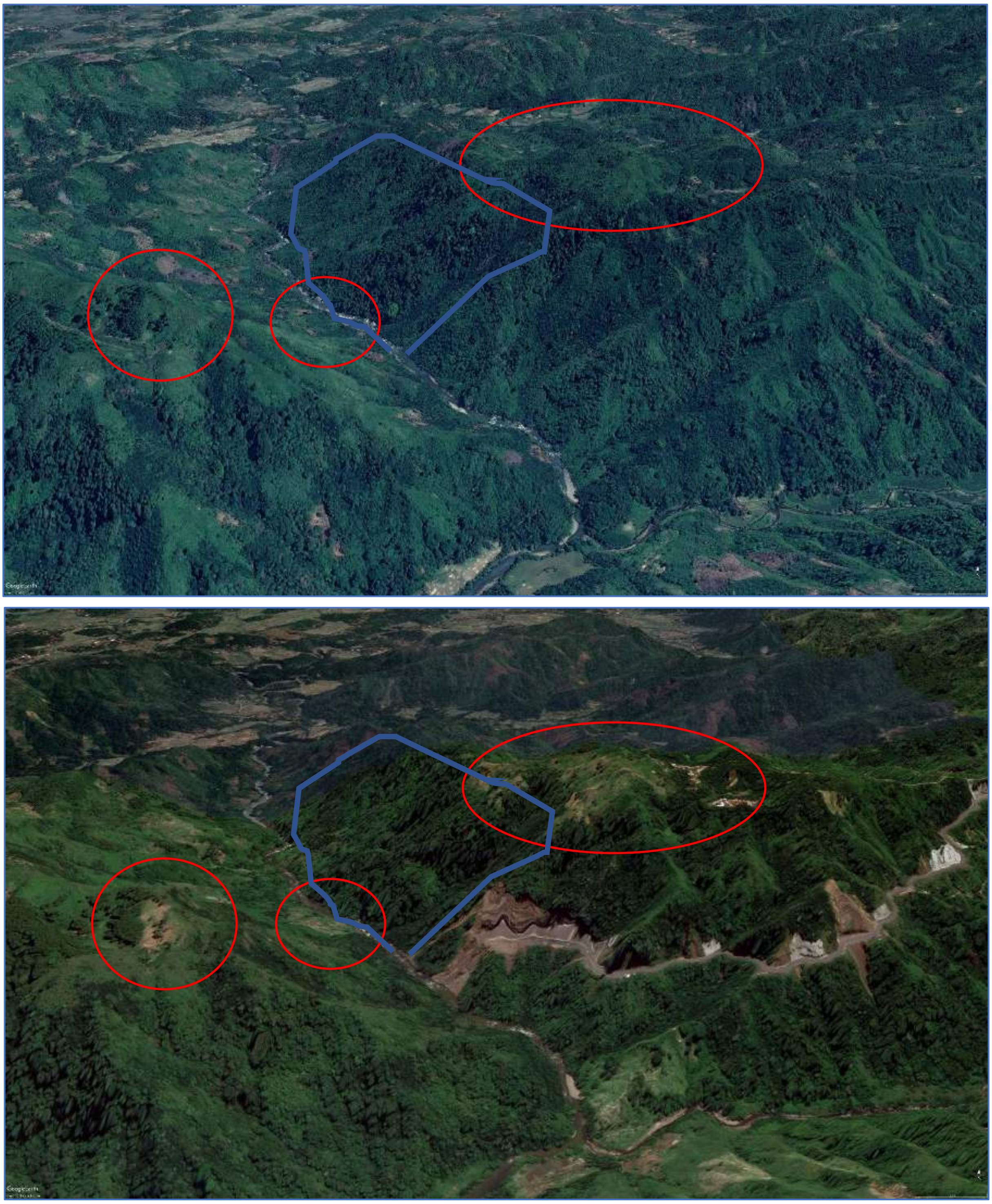


Figure 51. Location of Lower Dam (top) 2013 and (bottom) 2020 with red circles showing ongoing land clearing for agriculture during the time the access road was developed. The blue line indicates the approximate boundary of Gowek forest.

Historic and recent satellite imagery also shows that there are still agricultural activities on lands in the upper dam area that have been released by PLN (Figure 52), which is due to the PLN policy allowing the community to cultivate the land until the time of inundation is carried out.

Pasir Jegud Resettlement is located on the side of the main road, close to the settlement of Citapos Village. It can be seen in Figure 52, the Pasir Jegud resettlement location has been completed. There are also additional settlements along the access road (Figure 52).

Figure 52. Location of Resettlement Pasir Jegud, Sukaresmi Village (top) 2013 and (bottom) 2020.

The location of the Pasir Laja resettlement village can be seen in satellite imagery (Figure 53). Pasir Laja can be accessed through the access road along the ridge on the border of Cianjur and West Bandung Regencies. The location of the Pasir Laja Resettlement in 2013 was a limited agricultural land area with two houses. However, some of these land areas belong to communities in Lembur Sawah Village. Relocation due to the UCPS project, resulted in the community occupying the Pasir Laja area as a place to live. Satellite imagery captured in 2020 shows agricultural activities in the Pasir Laja area leading to the Gowek Forest area, which has potentially negative biodiversity implications.

Figure 53. Location of Resettlement Pasir Laja (top) 2013 and (bottom) 2020

6.6 Ambient Air Quality, Noise and Vibration

The baseline UCPS air quality, noise, and vibration data were obtained from the 2007 UCPS ANDAL PLTA data and the semester monitoring reports from 2014 - 2019. The main parameters monitored are Nitrogen Dioxide (NO2), Sulfur Dioxide (SO2), Dust (TSP), Carbon monoxide (CO). Figure 54 shows the location of the 5 monitoring locations which are situated in close proximity to the quarry, at two points on the access road, at the upper and lower dam location.

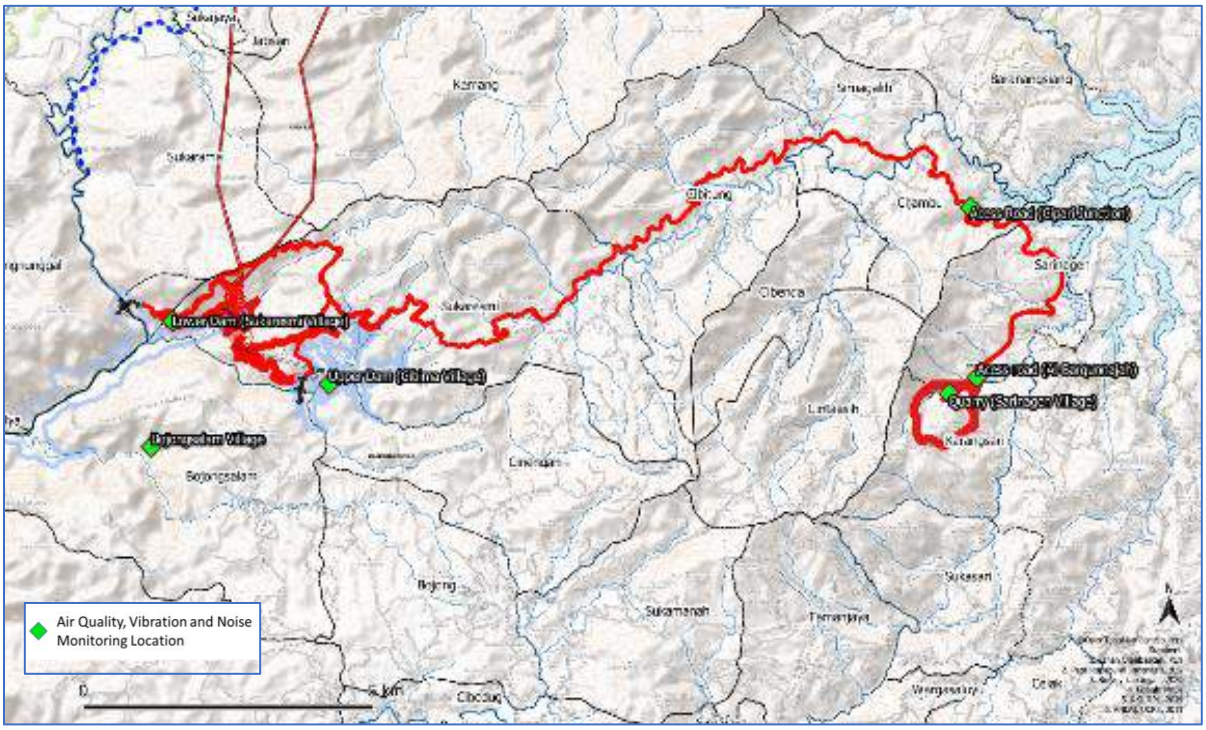


Figure 54. The location of ambient air quality, noise, and vibration measurement points

The baseline measurements of air quality and noise from the 2007 UCPS PLTA ANDAL document which represent the conditions before project activities in 2007 are presented in Table 19.

Table 19. Ambient air quality, noise and vibration ANDAL 2007 UCPS Hydropower Plant

Parameters	Unit	Standard (GR 41/1999)	Location				
			Quarry	**Cipari Junction**	**Cijambu Cross**	**Upper dam Cibima Village**	**Lower dam Sukaresmi Village**
Dust (TSP)	µg/m³	230 µg/m³/ Averaging time 1 hour	73.93	63.71	69.07	54.69	36.02
CO	µg/m³	30000 µg/m³/ Averaging time 1 hour	140.4	397.8	304.41	302.61	204.45
SO2	µg/m³	900 µg/m³/ Averaging time 1 hour	392.21	278.64	331.67	210.67	141.37
NO2	µg/m³	400 µg/m³/ Averaging time 1 hour	<4	<4	<4	<4	<4

Noise	dBA	55	42.3 - 54.3	50.2 – 73.5	50.2 – 69.5	45.52 – 49.28	45.65 – 54.65
Vibration	mm/sec	-	-	-	-	-	-

Source: (PLN, 2007)

Monitoring of air quality, noise and vibration conditions around the UCPS site is carried out twice a every year as per the RKL-RPL requirements. The measurement period is in May and October.

6.6.1 Ambient Air Quality

The monitoring results of the main observed air quality parameters are as follows:

6.6.1.1 Dust (TSP)

Total Suspended Particulate data (TSP) in locations around UCPS were collected from seven monitoring points between 2014-2019 for the period during early works (access road). Based on the graph in Figure 55 below, it is seen that the trend of dust data in locations around UCPS is fluctuating with a generally increasing trend. In October 2018, it was noted that the dust condition (TSP) had passed the required threshold. However, in 2019 this condition has declined again. The fluctuation of dust (TSP) around UCPS is influenced by an increase in the activity of the access road construction until 2019. However, a comparison with the results of dust measurement (TSP) from the 2007 ANDAL (EIA) document, prior to the commencement of any project activities at UCPS, an increase in general dust levels is seen since 2015.

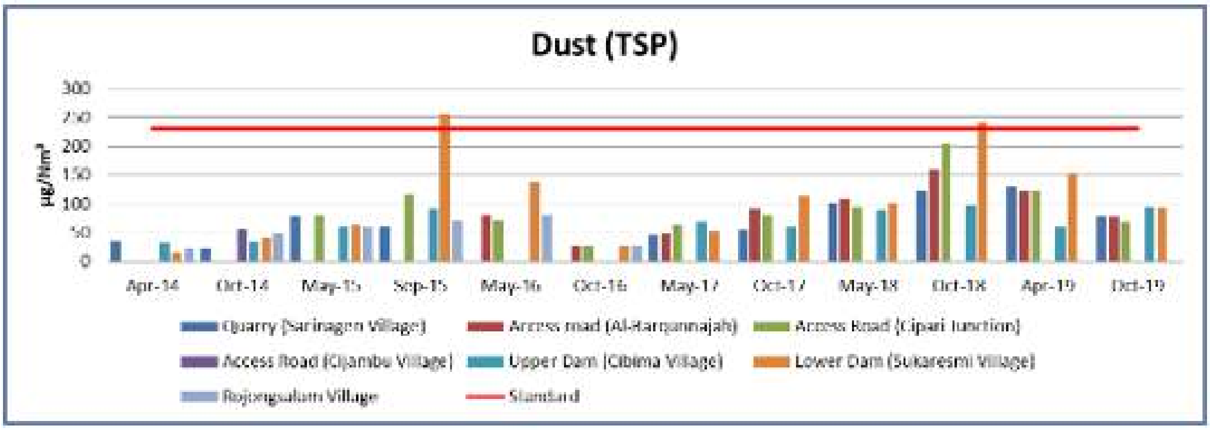


Figure 55. Total Suspended Particulate (TSP) data in UCPS area in relation to government standard

6.6.1.2 Carbon Monoxide (CO)

Generally, the air quality condition of the CO parameters in the locations around UCPS is still far below the maximum threshold allowed. The increase in CO occurred in 2018 - 2019 in the access road (Cipari junction) and Lower Dam (Sukaresmi Village). The increase occurred due to the mobilization of vehicles and trucks during the construction of the new access road. The trend of CO data in the area around UCPS is shown in Figure 56.

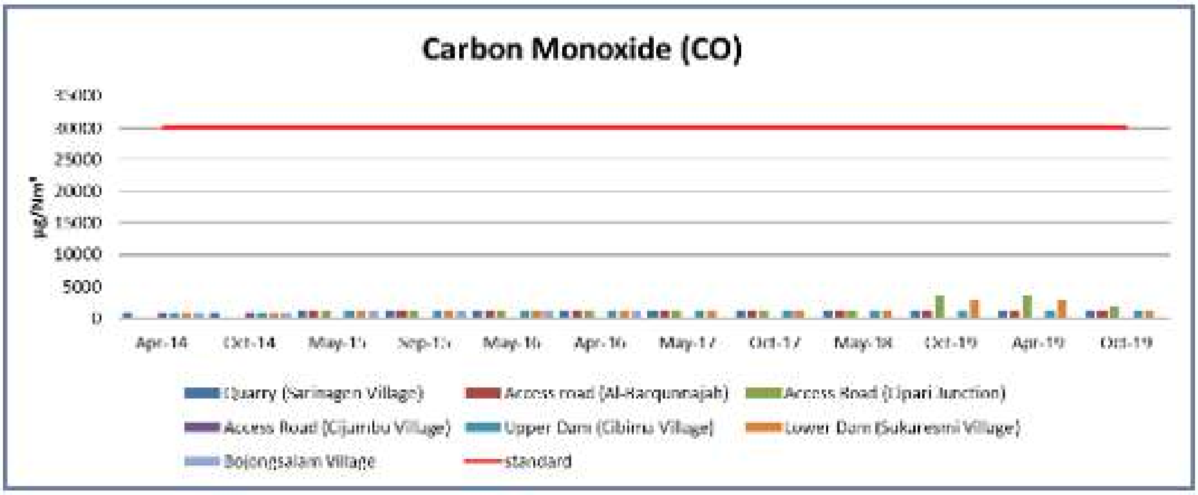


Figure 56. Carbon Monoxide (CO) trend data around UCPS

6.6.1.3 Sulfur Dioxide (SO_2)

In general, the air quality conditions of the SO_2 parameters in the locations around UCPS are still far below the maximum threshold required. The increase in CO occurred in 2018-2019 in the access road (Al-barqunnajah), access road (Cipari junction) and Lower Dam (Sukaresmi Village). The trend of CO data in the area around UCPS is shown in Figure 57.

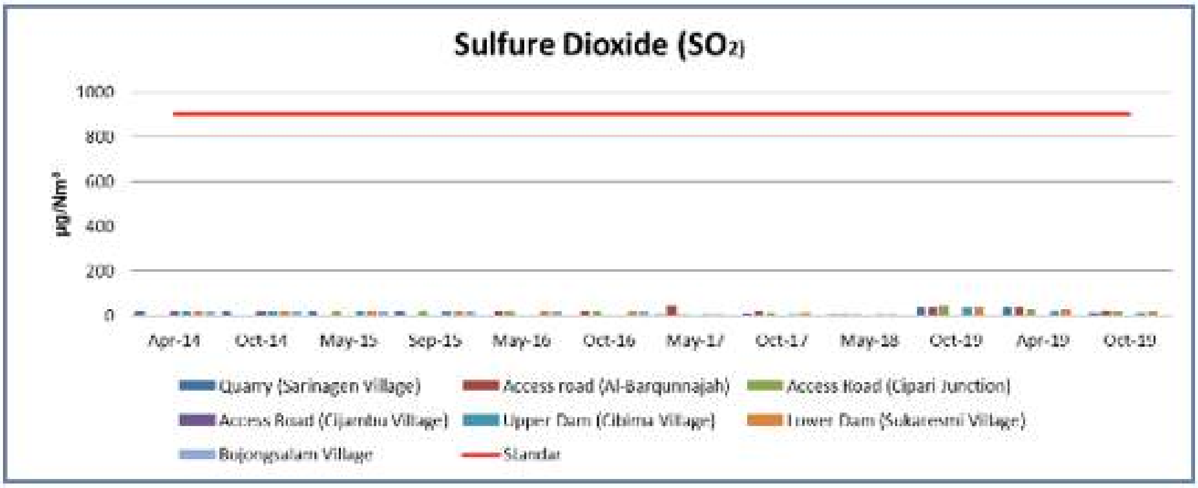


Figure 57. Sulfur Dioxide (SO_2) trend data around UCPS

6.6.1.4 Nitrogen Dioxide (NO_2)

The trend of NO_2 data shows fluctuating conditions from 2014 to 2019 (Figure 58). In 2014, NO_2 levels showed a high value compared to other measurement years. The NO_2 level after 2014 has decreased up to 2017. The increase again occurred from October 2017 to October 2019. The intensity of the construction of access roads in these years had an effect on the increase in NO_2 levels in the area around UCPS.

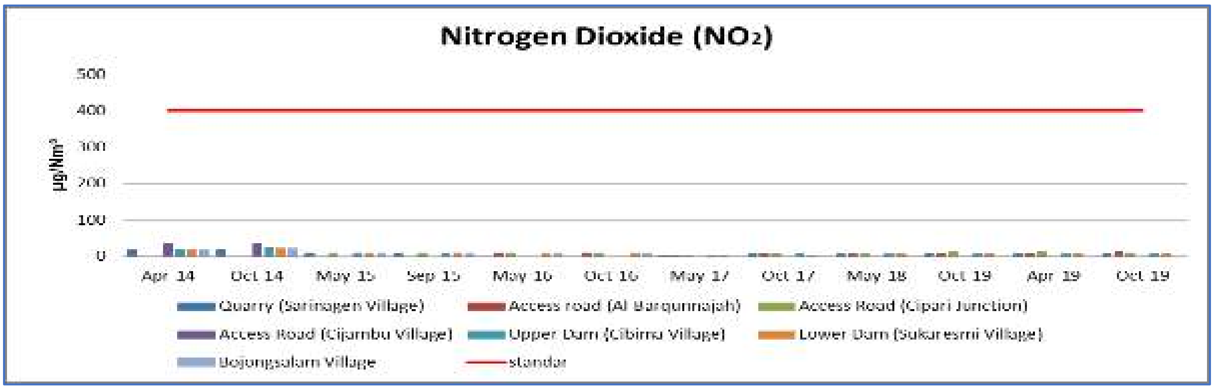


Figure 58. Trending Nitrogen Dioxide (NO_2) data around UCPS

6.6.2 Noise

The noise level at all monitoring points tends to be high from 2013 to 2019 at the monitoring points around the access road. This is inseparable from the activities of mobilizing vehicles and heavy equipment during the pre-construction and conveyor road construction processes. However, this condition is not much different from the results of monitoring in 2007 before any development activities in the UCPS area where the noise at the monitoring location was between 42.5 to 73.5. In some locations the noise level has exceeded the threshold required for residential locations, institutions, and education. The trend noise data is shown in Figure 59.

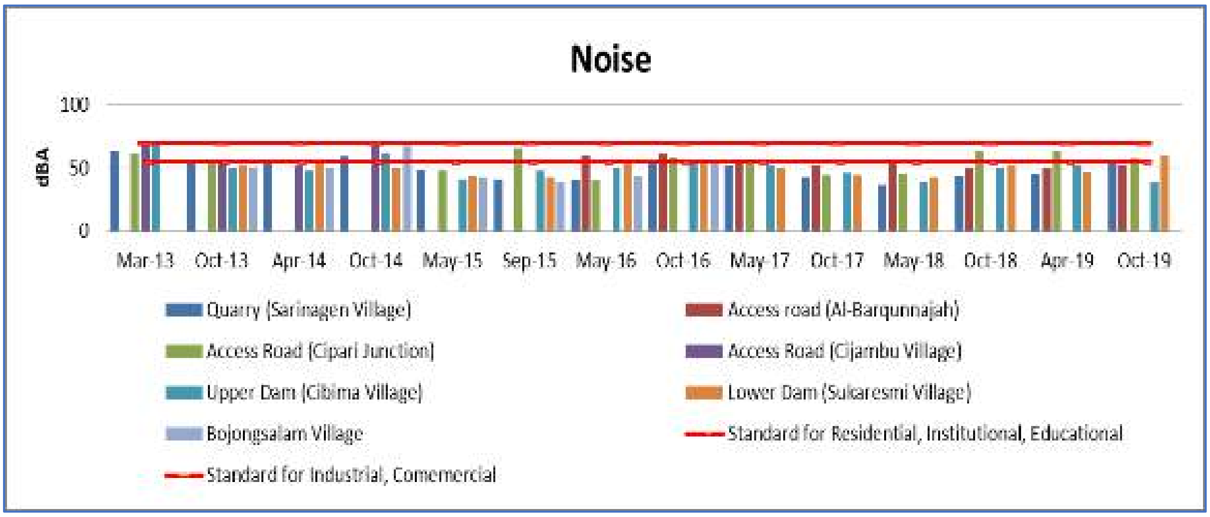


Figure 59. Noise Data Trend around UCPS

6.6.3 Vibration

Vibration levels from 2015 - 2019 in the area around UCPS fluctuated strongly (Figure 60). High levels of vibration conditions were found in May 2016 and October 2017 at locations around UCPS. The level of vibration resulting from the construction of the access road is still below the government safety threshold.

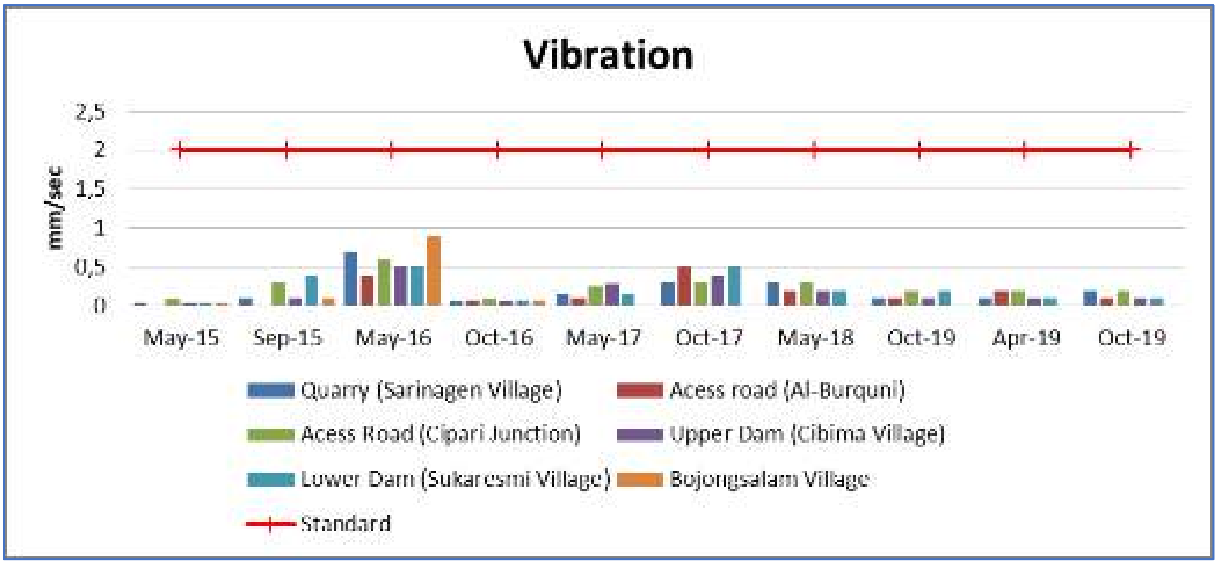


Figure 60. Vibration data around UCPS

6.6.4 Sensitive receptors to noise, air quality and vibration

At the time the construction activities were running. Increased parameters of air quality, noise and vibration will be felt directly by sensitive receptors around the UCPS area. The locations of sensitive receptors in the vicinity of the UCPS area are modelled based on assumed air quality, noise and vibration impacts (Figure 61).

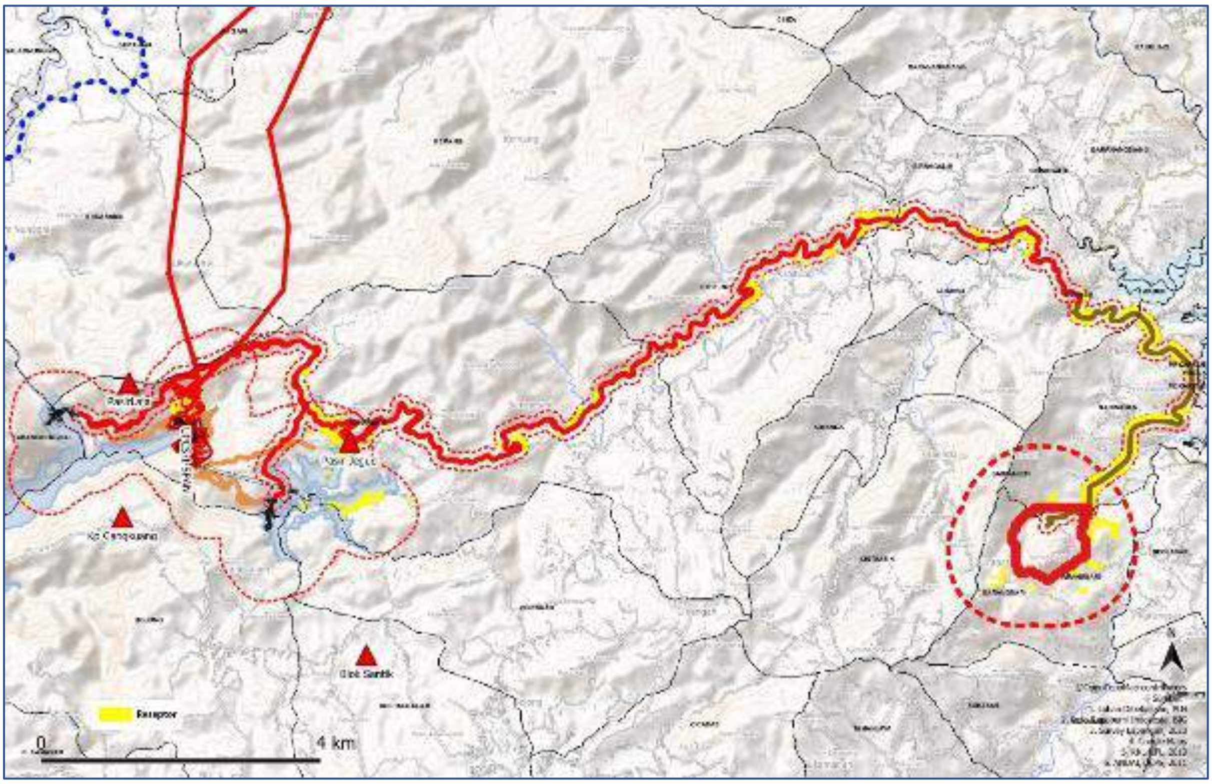


Figure 61. Sensitive Receptors (residential properties) in the vicinity of the quarry, access road and upper and lower dam areas. Yellow areas are those were air quality, noise and vibration are likely to affect communities.

6.7 Hydrology

6.7.1 Watershed Overview

The UCPS project is located in the central Citarum River Basin, which flows into the Cirata reservoir. Downstream of the Cirata Reservoir is the Jatiluhur and Walahar reservoirs, before the river flows to the Java Sea, see Figure 62. The Citarum River drains water from much of West Java, including the city of Bandung.

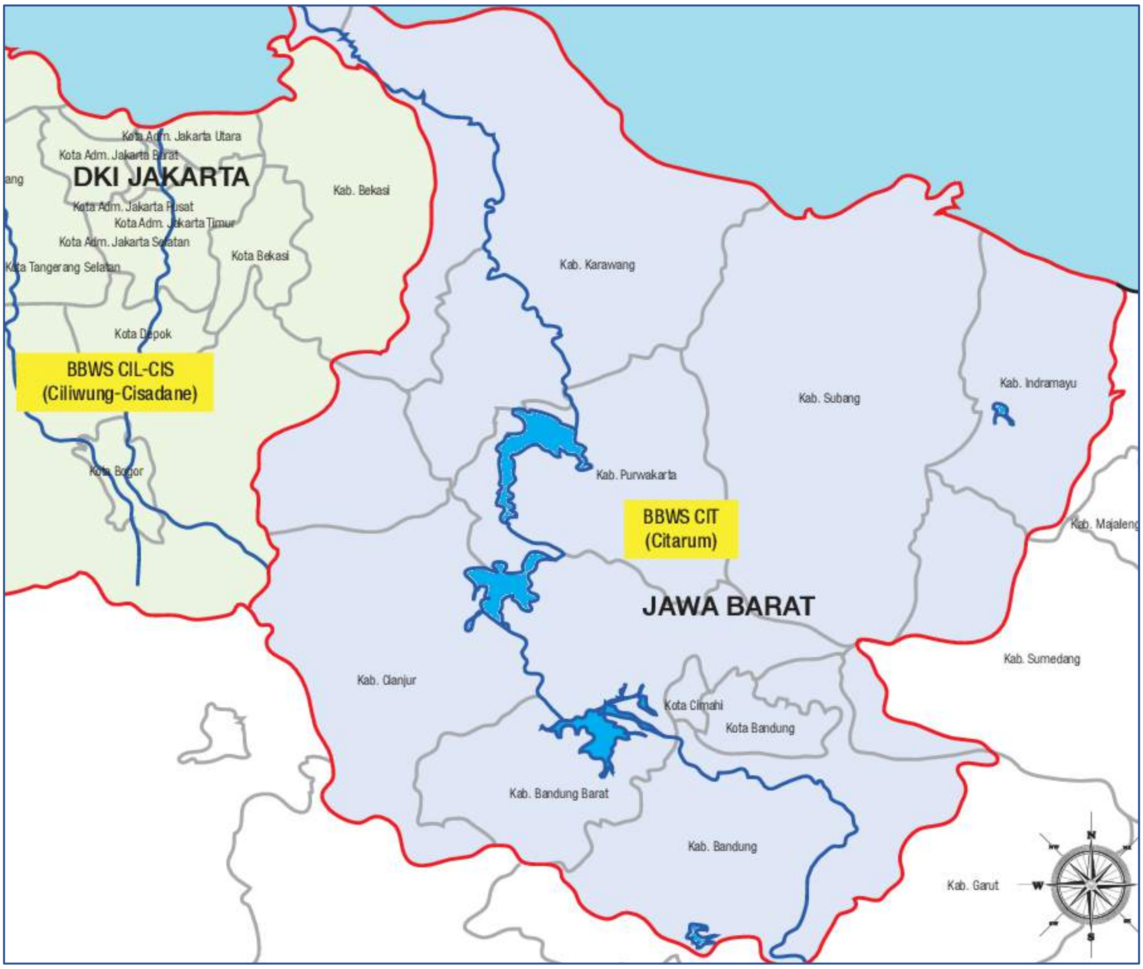


Figure 62. The Citarum Watershed with the Cirata, Jatiluhur and Walahar reservoirs (Nes and Firmansyah 2013).

The catchment area of the lower dam on the Cisokan River is about 374 km^2. Two notable sub-watersheds are the Cirumamis (location of the upper dam) and the Cilenkong (which has a confluence with the Cisokan River immediately upstream of the lower dam).

The catchment area for the upper dam on the Cirumamis River is 10.5 km^2. There are several streams that flow into the Cirumamis River, such as the Cilawang, Cipateunteung, Cibima, and Cidongke. The location of Cirumamis watershed within the Cisokan watershed is presented in Figure 63.

The UCPS project area does not only cover the Cisokan watershed which empties into the Cisokan River, but there is some river flow that empties into the Saguling Reservoir. The rivers include the Cijambu River along the new access road and the Cirendeu River around the quarry area of Mount Karang. The Cisokan and the Cijambu watershed have different drainage density patterns, apart from the size and physical characteristics of the watershed.

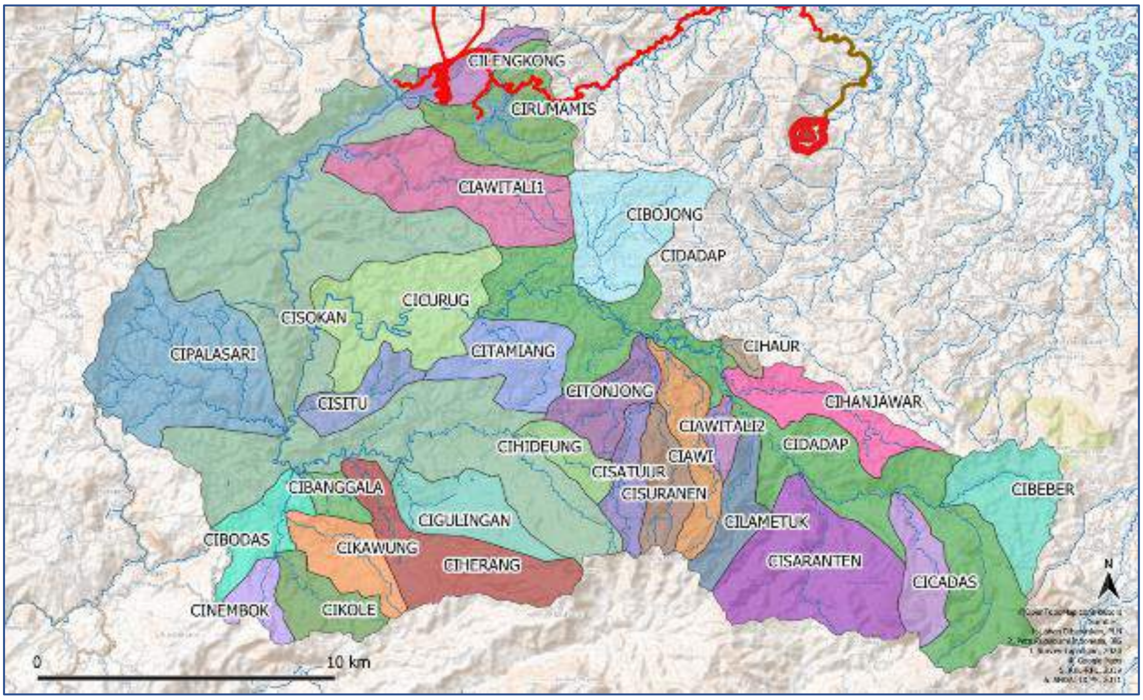


Figure 63. Drainage Pattern in Cisokan sub-Watershed

Watershed hydrology in the UCPS region is influenced by rainfall, geology, topography and land cover. The varying density of drainage patterns in the Cisokan watershed reflects the relief conditions and lithology of the constituent rocks. The drainage density indicates that the Cisokan watershed has several levels of infiltration based on the physical characteristics of the land. The difference in drainage density indicates the difference in the lithology of the rock and its landscape. The tributaries in the upper dam area (Cirumamis watershed) tend to have low discharge characteristics over a long period but do not significantly reduce during the dry season, indicating that groundwater contributes to base flow in this season. This is in contrast to the Cisokan River which has a much larger and more complex geological and topographical watershed and responds more directly to rainfall. At the lower dam location, the Cisokan River has a high discharge character in the rainy season and low discharge during the dry season.

The eastern area of the Cisokan watershed shows a lower river drainage density, this indicates that the rate of infiltration of rainwater into the soil at the soil surface is higher, or the lithology of the rock is more dense or porous so that water flows into the relief layer or it can occur because the rock is not experiencing erosion. The map in Figure 57 shows the flow pattern of the Cisokan watershed in each of its sub-watersheds.

Meanwhile, in the Cijambu watershed, the drainage patterns formed are mostly semi-parallel, semi-dendritic, dendritic and trellis. The dominant semi-parallel pattern is on land with high slopes in the upstream area. Dendritic and semi-dendritic occur in the cavity of the basin downstream area. Trellis flow patterns occur in several places locally mainly due to structural processes that form the landscape of the area such as the Cijambu River along the main road which tends to form trellis flow patterns. In detail, the spatial distribution of drainage density in the Cijambu watershed is presented in Figure 64.

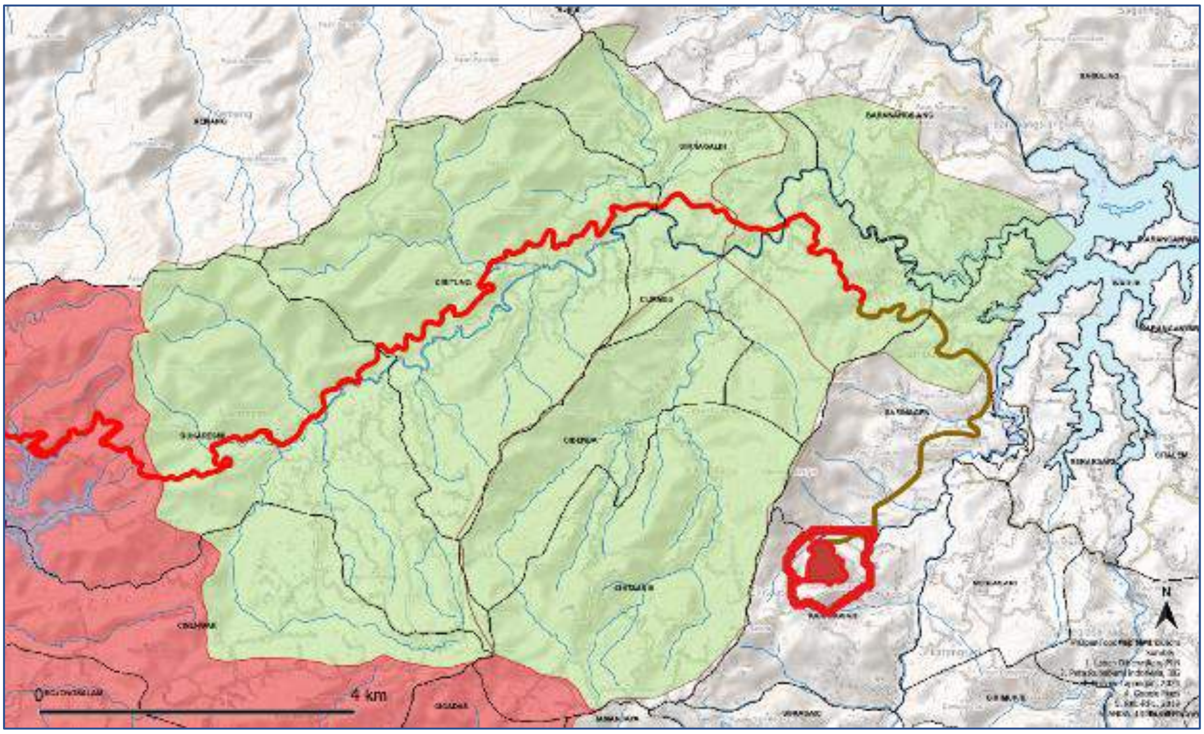


Figure 64. Drainage Pattern in Cijambu sub-Watershed

6.7.2 River Characteristics

The characteristics of the Cisokan river at the lower dam area are presented in Figure 65. The Cirumamis River in the upstream is relatively small and increasing in size downstream from the tributary the Cilengkong River before entering the Cisokan River. The Cirumamis River flow in the upstream part is very heavy. This is influenced by the condition of the slopes around the river which are steep and narrow, so as to form a waterfall called Curug Walet.

Figure 65. Cisokan River at the site of the lower dam

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 reservoir. The river flow gradient is relatively flat with characteristics of rocky water bodies with a narrow terraced river shaped 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.

Figure 66. Cirumamis Upstream (Left) and Downstream (Right)

Characteristics of the rivers are shown in Table 20.

Table 20. Cirumamis and Cisokan River Characteristics

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

6.7.3 River Flow

Very little hydrology has been recorded in the Cirumamis river catchment. The 2011 ESIA presented data indicating monthly average flows between 0.1 – 0.4 m^3/s at the upper dam location based on one field measurement and catchment correlations between Cirata and Saguling flow data.

Various river flow studies at the UCPS project site have been carried out since 1995. Information and analysis of river flows is used to obtain an overview of low-flow and river flood discharge, which aims to carry out planning, design and management of the UCPS environment and operations. Table 21 shows the series of hydrological and design studies that have been carried out at UCPS.

Table 21. UCPS Hydrology and Design Study History

No.	Title	Duration	Consultant	Reports
1.	The Upper Cisokan Pumped Storage Hydroelectric Power Development Project in the Republic of Indonesia	Oct 1992 to Mar 1995	PT. PLN (site investigation) NEWJEC	Feasibility Study Report (FS 1995)
2.	Engineering Services for Upper Cisokan Pumped Storage Hydroelectric Power Plant Project	Aug 1999 to May 2002	NEWJEC PB Power PT. Connusa Energindo	Basic Design Report Detailed Design Report (DD 2002) Bid Documents EIA Report
3.	Engineering Services for Java Bali Power Restructuring and Strengthening Project for Upper Cisokan Pumped Storage Hydro Power Plant Project	Apr 2006 to Mar 2007	NEWJEC Colenco Power Engineering PT. Hasfarm Dian Konsultan PT. Kwarsa Hexagon	Supplemental Detailed Design Report Revised Bid Documents incl. Access Road, Base Camp and Transmission Line
4.	Engineering Services for Pre-Construction and Construction Phases of Upper Cisokan Pumped Storage Power Plant Project	Dec 2012 to Sep 2017	Sinotech Hydrochina PT. Hasfarm Dian Konsultan PT. Indra Karya	Revised Detailed Design (DD 2013) Revised Bid Documents
5.	Watershed Management Study (Watershed Management) Upper Cisokan to Support Upper Cisokan Pumped Storage	Jul 2012 to Sep 2013	PT. Geotrav Bhuana Survey	Estimating Flow Discharge Estimating and Calculation of Erosion Rate Laboratory Test of Suspended Load and Bed Load
6.	Engineering Services for Measuring Discharge in Cisokan River Using AWLR PLTA Upper Cisokan	Dec 2018 to Nov 2019	PT. Gama Epsilon	Estimating Flow Discharged Updating Rating Curve
7.	Engineering Services for Updating Detailed Design and Preparing Construction Drawing of Upper Cisokan Pumped Storage Power Plant Projct	Oct 2019	Nippon Koei NEWJEC PT. Indokoei International PT. Wiratman	Review and update hydrological conditions Revised Detailed Design (DD 2017)

There is no water level recorder or flow information from the upper or lower dam locations. Cisokan River hydrology is this section is presented in two forms: 1) Flow measured downstream at the Cisokan Weir (Cihea Irrigation Scheme) and 2) simulated flow at the lower dam site based on Manglid station data (located downstream of the Cisokan Weir).

6.7.4 Cisokan River at the Cisokan Weir

In 2020, secondary data collection of the Cisokan River discharge and water retrieval was carried out from data from the Cisokan Weir (Cihea Irrigation Scheme) from 2001-2020. The data is carried out as an update of information and supported on hydrological data from previous studies. The discharge of the Cisokan River at Cisokan Wier for 20 years is then presented using an annual discharge graph (Figure 67) and flow duration curve (Figure 68). results of Q95 analysis based on data in the Cisokan Weir is 0.66 m^3/s, while the 7-days mean low-flow average for 20 years shows a value an average of 1.04 m^3/s.

The graphs indicate that the catchment is highly responsive to rainfall and recedes rapidly following a rain event. The river sustains higher flow during the wet season and has long periods of low flow during the dry season.

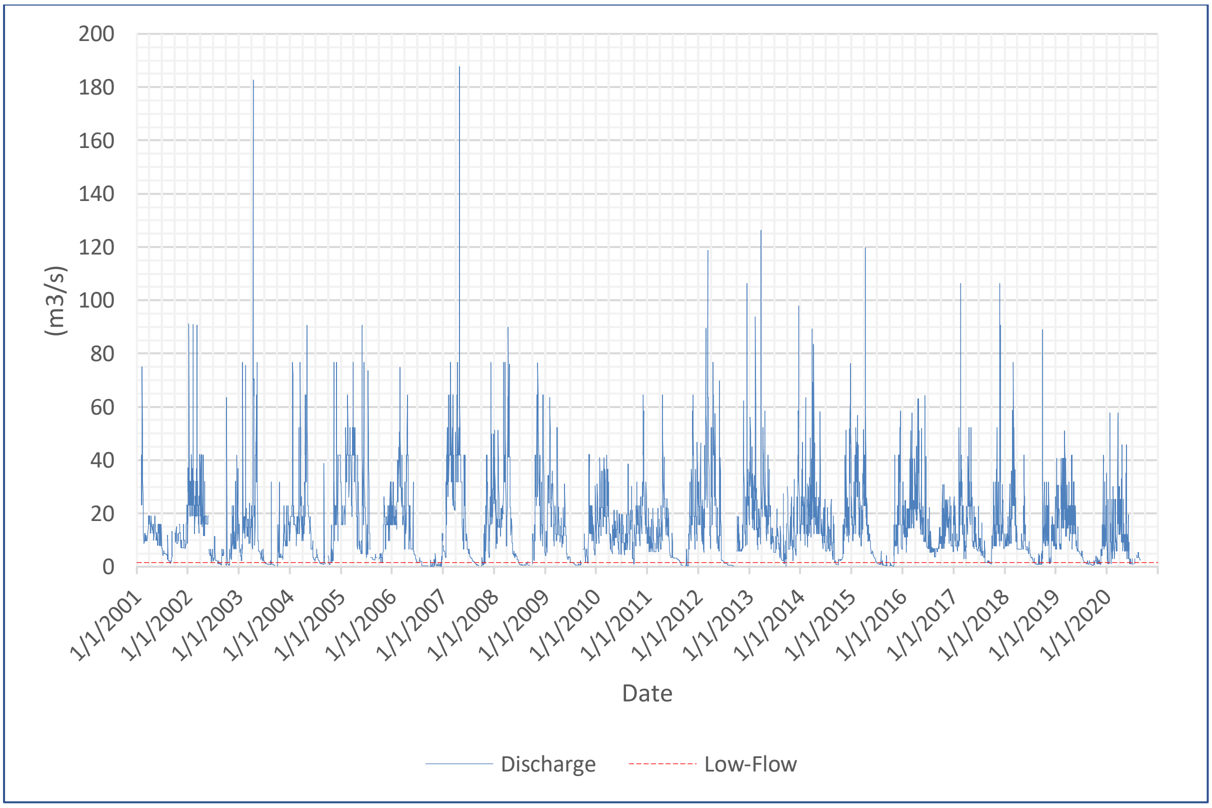


Figure 67. Annual Flow Hydrograph, Cisokan River at the Cisokan Weir (Cihea Irrigation Scheme) 2001-2020

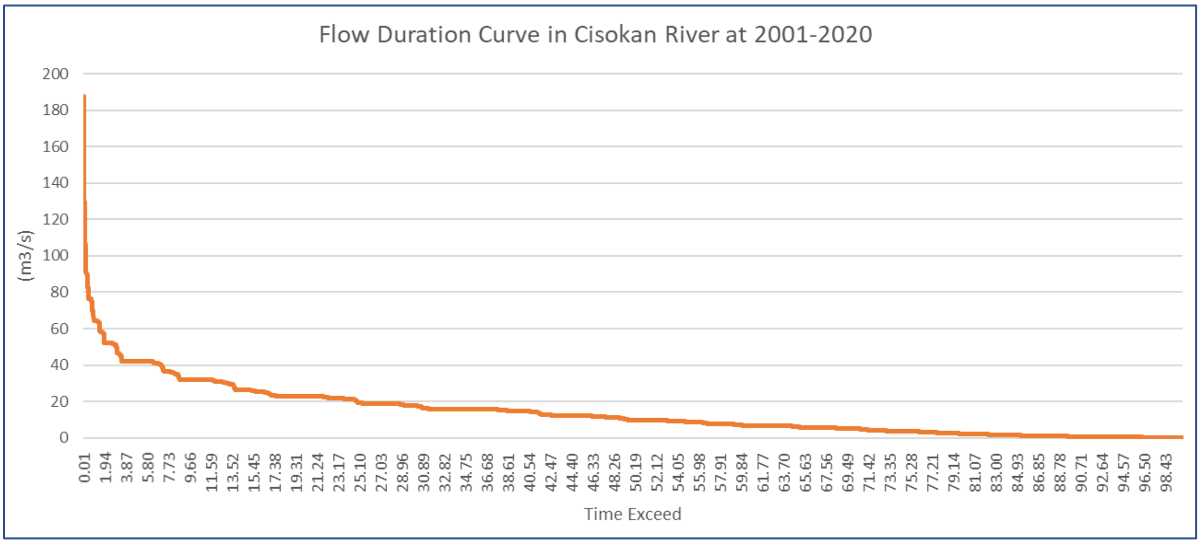
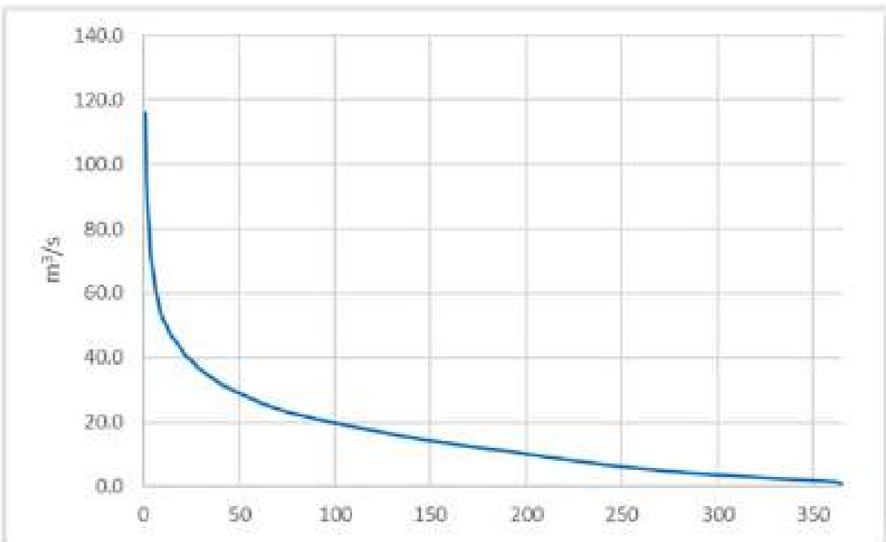


Figure 68. Flow Duration Curve Cisokan River at the Cisokan Weir (Cihea Irrigation Scheme) 2001-2020

6.7.5 Cisokan River at the UCPS Lower Dam

In 2019, renewal of hydrological studies was carried out with the aim of confirming the suitability of the hydrological conditions used for: 1) hydraulic design of the dam 2) diversion channels and temporary holding weirs 3) sedimentation and 4) inundation procedures (PLN Enjiniring/Nippon Koei/Newjec Inc./Indokoei International/Wiratman, 2019b). The detailed dam design is being adapted to the latest hydrological and reservoir sedimentation analysis. The hydrological study in 2019 uses discharge data at the Manglid station which is then converted into a flow duration curve for the lower dam site, based on the ratio between the Manglid station's watershed and the watershed at the lower dam. This is illustrated in Figure 69.



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

Figure 69. Estimated Flow Duration Curve Hydrograph of Cisokan River at the Lower Dam site, based on Manglid Station Data

Table 22. Estimated Average Monthly Mean Flow Cisokan River at the Lower Dam site, based on Manglid Station Data

	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Annual
	Wet Season						Dry Season						
Average m³/s	20.76	15.82	24.05	25.45	27.20	18.10	9.94	6.70	4.58	6.54	8.56	19.81	15.55
Seasonal Average m³/s	21.90						9.36						

The range of average monthly mean flow is estimated from 4.58m³/s in August (dry season) to 27.20m³/s in April, near the end of the wet season, and the annual average monthly mean flow is estimated at 15.55m³/s. The median flow is approximately 11.4 m³/s (based on 185 days) and 97 percentile is 1.7m³/s.

6.7.6 Flood Discharge

Flood discharge at the upper and lower dam sites has been calculated based on the maximum daily rainfall from rainfall station data near the project area (Sindang Kerta and Montoya stations) using the Generalized Extreme Value (GEV) approach (PLN Enjiniring/Nippon Koei/Newjec Inc./Indokoei International/Wiratman, 2019b). The flood discharge probability then estimated based on the probability of rain in the upper and lower dams using the hydrograph unit analysis using HEC-HMS software, so that the flood discharge values are obtained for the return period from 2 years up to 10,000 years as in Table 23.

Dam Site	Catchment Area (km²)	Item	PMF	Return Period (Year)						
				10000	1000	100	20	10	5	2
Upper Dam	10.5	Q_m(m³/s)	333	230	185	133	98.0	86.0	74.0	42.7
		W_{24h}(10⁶m³)	4.24	2.47	2.06	1.61	1.25	1.10	0.94	0.69
Lower Dam	374	Q_m(m³/s)	2430	1430	1160	891	460	370	284	173
		W_{24h}(10⁶m³)	104.8	60.3	48.4	37.0	29.0	16.8	13.8	9.01

Table 23. Probability of Flood Discharge at Any of Return Period in Upper and Lower Dam

It is common for the Cirumamis River at the upper dam to experience flows of over 40m³/s during rain events but rarely over 100m³/s. It is common for the Cisokan River at the lower dam to experience flows of over 170m³/s, which indicates large annual variations between low flow and high flow in response to rain events. The data shows that occasionally flood flows will exceed 450 – 500m³/s. The 10,000 peak flood flow at the lower dam is estimated at 1,430m³/s.

6.8 Downstream Users of Cisokan River

The downstream areas through which the Cisokan river flows are Salamnunggal, Panyusuhan, and Cikondang. After these three villages, the Cikondang River enters the Cisokan River. The location of the Cikondang River entry into the Cisokan River is shown in Figure 70.

Because of the high cliffs of the Cisokan River only a handful of people have direct access to the Cisokan River either for fishing or as a means of access clean water needs. The communities in the three villages only access the Cisokan river during the dry season for bathing and washing purposes, while during the rainy season people do not access the Cisokan river water directly. The large discharge and high-water level of the Cisokan River during the rainy season are a safety concern for the community in using the Cisokan River. The surrounding community used to catch fish from the river, but not for commercial purposes. Peoples use nets, fishing lines and electric fishing gear to catch small amounts of fish. The community's location which is closer to the Cirata Reservoir makes fishermen more interested in fishing in the Cirata dam compared to the Cisokan River.

The main use of the Cisokan River downstream of the lower dam is as a source of irrigation water for the Cihea Irrigation Area (DI). The Cisokan River water flow is utilized by the Cisokan Dam (local people call it the Cisuru Weir) where water is channeled into the Cihea irrigation as the main source of irrigation for 5,484 hectares of paddy fields in Cianjur Regency (Figure 71). The Cisokan Dam (Cisuru Weir) (Figure 72), is about 3 km downstream of the UCPS lower dam.

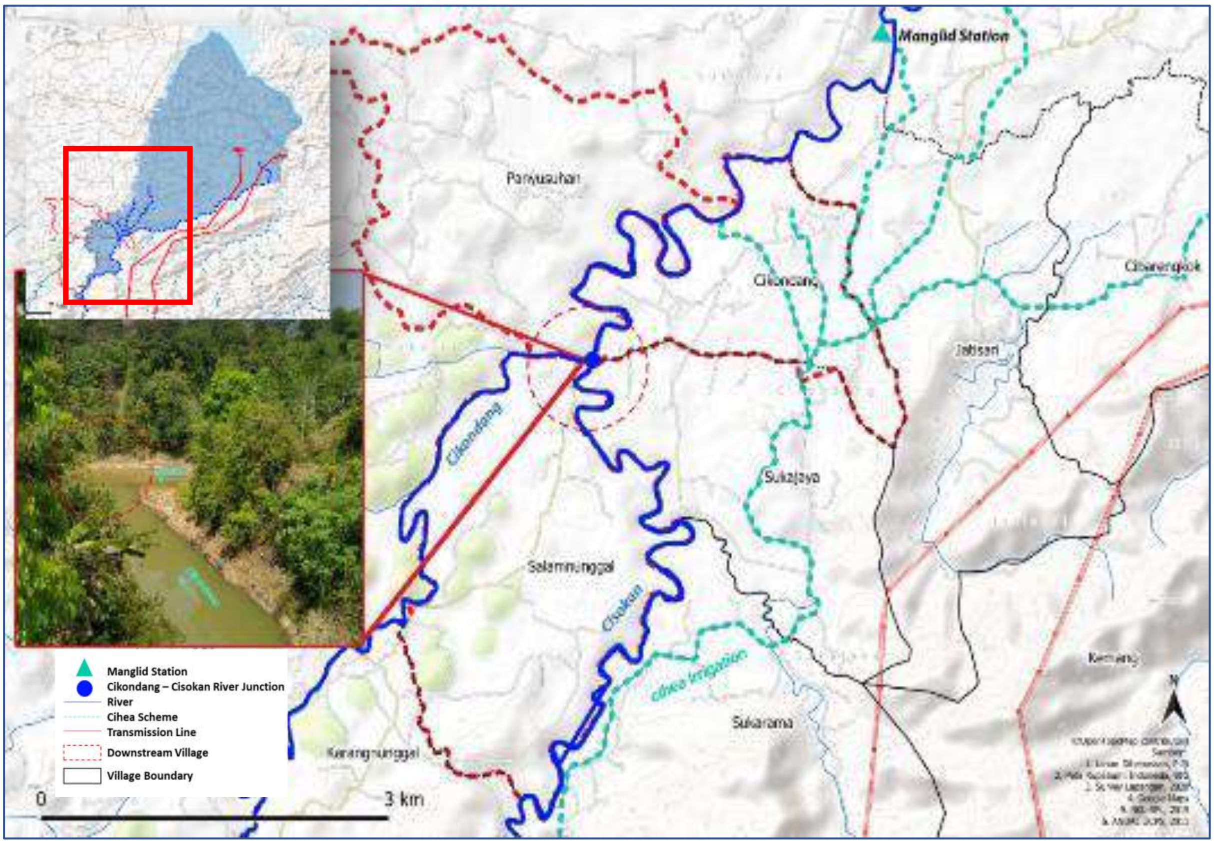


Figure 70. The meeting point of the Cisokan River and the Cikondang River in the Downstream Village of the Cisokan River

Cisokan River is channeled to the Cihea irrigation scheme through the Cisokan Dam. Field observations in 2020 show that along the primary irrigation channel of Cihea many people use irrigation water that passes in front of their houses, not only for agricultural needs but also for daily needs such as bathing and washing.

The current operational system of the Cisokan Dam in the dry season is to divert all of the Cisokan River water flow to the Cihea scheme so that no water is left to flow through the weir body. The Cisokan River can remain dry until the confluence between the Cisokan River and the Cikondang River. In the rainy season with high water flow, the intake to the Cihea scheme is opened gradually in accordance with the conditions of the Cisokan River flow. The withdrawal of water during the rainy/flood season is at the maximum capacity of the irrigation channel. These conditions are shown in Figure 72.

The Cihea irrigation scheme has an area of 5,484 ha. Based on the organizational structure, the water user farmer association (P3A) in Cihea consists of 1 (one) IP3A parent, namely IP3A Tirta Mulya Rezeki, 3 (three) P3A Combined namely Group I Titra Walatra, Group II Karya Sejahtera and Group III Sabandasariksa. The number of P3A partners in the Cihea irrigation area is 82 partners, with details of Group I as many as 21 partners, Group II consisting of 27 partners and Group III consisting of 24 partners. The irrigation area for group I P3A was 1,863 ha, Group II was 1,852 ha and Group III was 1,769 ha.

Figure 71. Cisokan Weir (Cihea Scheme)

Figure 72. Cisokan Dam (Cihea Irrigation Scheme) (left) Dry Season (September, 2020) and (right) Flood Season (March, 2020)

The e-flow rate at UCPS will be greatly influenced by the water demand from the Cihea Irrigation Scheme. Discharge from UCPS must meet the needs of the Cihea Irrigation Scheme both in the rainy season and in the dry season as the main beneficiary of the Cisokan River, with the main objective of agriculture.

The observations made at the Manglid discharge observation station and the Cisokan Dam during 2015-2018 provide some information about variations in water discharge at the Cisokan Dam, as follow (PLN Enjiniring/Nippon Koei/Newjec Inc./Indokoei International/Wiratman, 2019b):

1. When the discharge at Manglid station was zero (i.e., 23-29 Oct 2015), intake in Cihea scheme was recorded at least 0.22 m^3/s.
2. Cisokan weir takes up about 80% of the flow rate, when the discharge at Manglid station is less than 1 m^3/s.
3. Cisokan weir takes up about 50% of the flow rate, when the discharge at Manglid station ranges from 1 - 5 m^3/s.

Discharge data at Manglid Station and Cisokan weir in 2015-2018 shows that there is a correlation between the measured daily discharge value of the Cisokan River at Manglid Station and water intake for Cihea scheme. The withdrawal of water for Cihea scheme will decrease according to the main flow conditions of the Cisokan River to a minimum of 0.22 m^3/s in the dry season. In addition, water extraction for Cihea scheme is only around 50% of the main flow rate of the Cisokan River in other seasons.

In 2020, secondary data was collected from observations of discharge at the Cisokan Dam from 2001 to 2020 (August 2020) (Figure 73). Data of runoff discharge in the weir body and uptake discharge to the irrigation channel are then analyzed and presented in the following Figure. In accordance with information in the 2019 study, there is an adjustment in discharge intake for irrigation channels along with a decrease in discharge in the main flow of the Cisokan River. From July to the end of September, the picture shows a decrease in the trend of water intake for irrigation channels. The lowest value is at the end of August to the beginning of September.

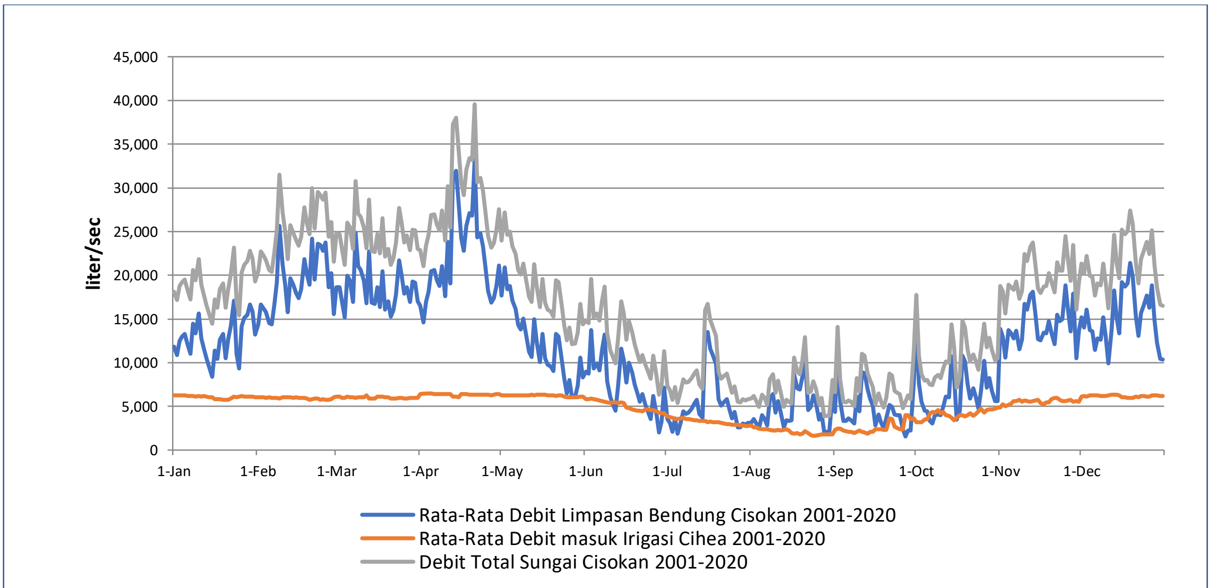
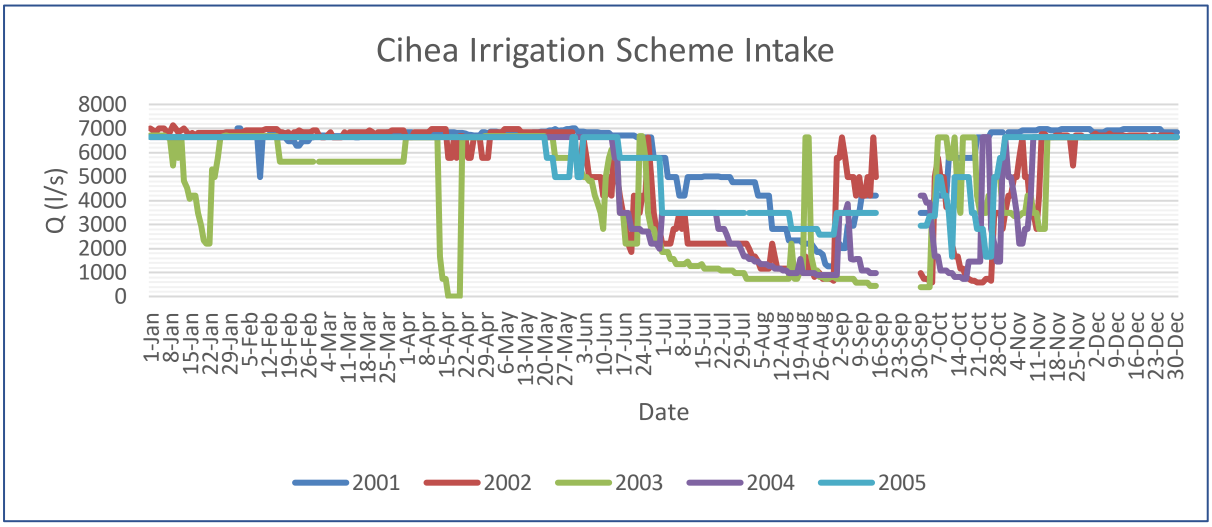
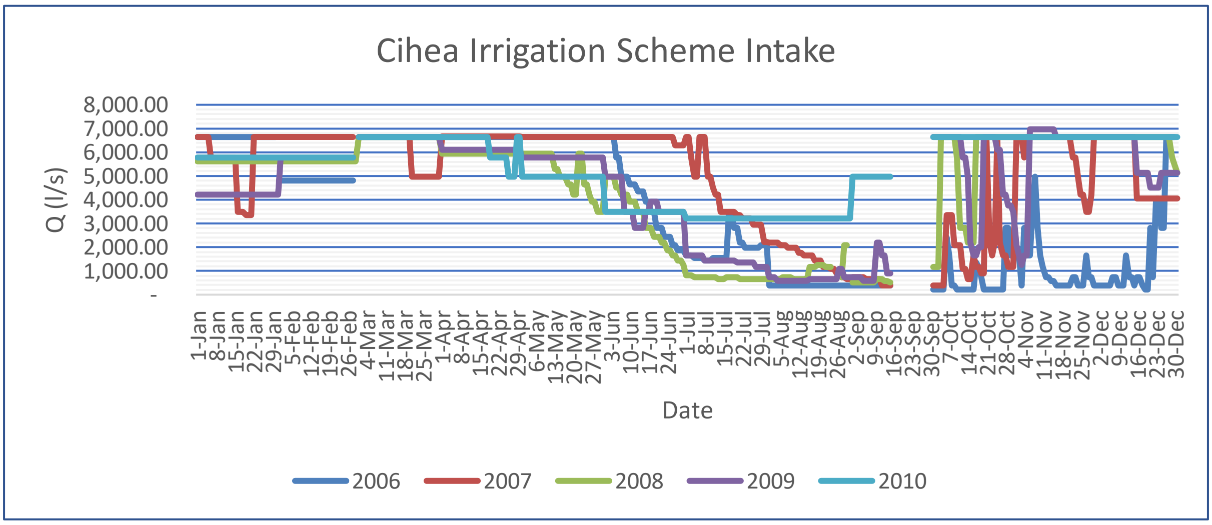


Figure 73. Average Cisokan River Discharge and Cihea Scheme Intake at 2001-2020

Based on these data, information was obtained about the need for irrigation water in Cihea in the rainy season with rice as the main crop requiring water with a maximum discharge of 7.13 m^3/s, the dry season (July - October) of 2.67 m^3/s. The lowest retrieval value (above zero due to data error or missing) is 0.22 m^3/s. The Cisokan River discharge has a minimum value of 1.31 m^3/s and a maximum discharge up to 180.96 m^3/s.

Figure 74 shows a graph of water uptake at the Cisokan Dam from 2001-2015. Water withdrawal is at a maximum at 6-7 m^3/s at several points. Water withdrawal also decreases gradually starting at the end of May to the end of September. If we look in more detail, during the 2001-2015 period, there was always a data gap in September (Figure 74). This is due to the annual maintenance of the weir. Weir maintenance is carried out from sediment dredging to underground channel inspection in the Cisokan Weir Primary Channel. Coinciding with that moment, there are local community traditional activities which are always celebrated at the Cisokan Dam on the same date. These local activities will be further discussed in the sub-chapter on Cultural Heritage.





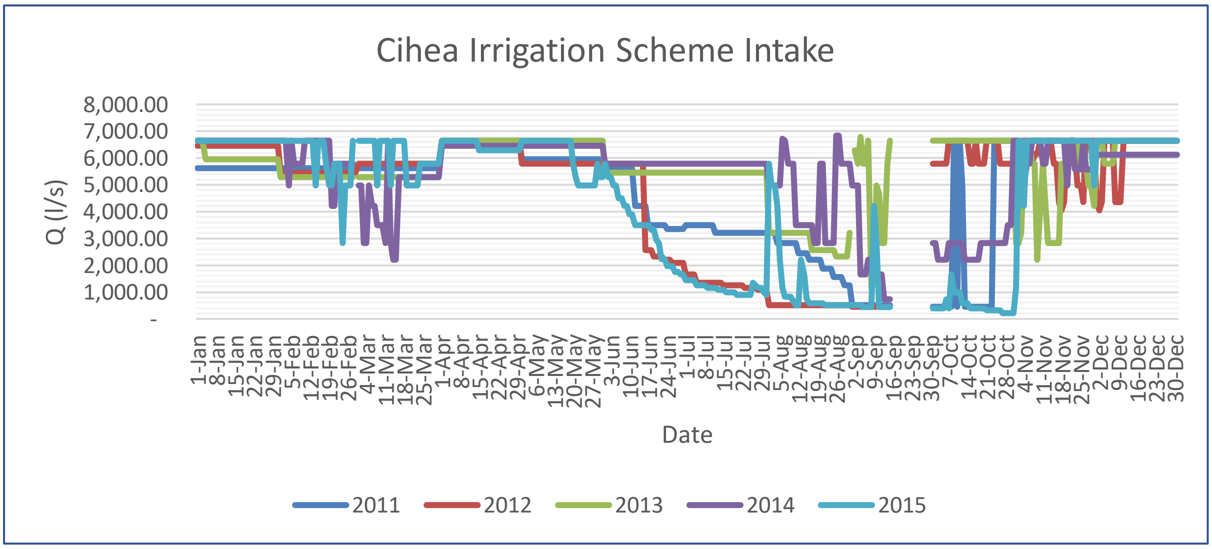


Figure 74. Cihea Scheme Water Intake Graph (2001 – 2015)

6.9 Surface Water Quality

Water quality observations were carried out every semester from 2012 to 2019. Water quality observations were carried out on the Cirumamis River, Cilengkong River and the Cisokan River which are the main rivers of UCPS. Other observations were made on the Cijambu River along the access road as well as several other rivers with the aim of obtaining more complete information regarding the flow in the catchment area of each river. Water quality measurements were carried out in May (semester I) and October (semester II). Meanwhile, data on the water quality of the Cirendeu river were obtained from the revised document for the 2011 UCPS Hydroelectric AMDAL. The location of river water quality observations is shown in Figure 75.

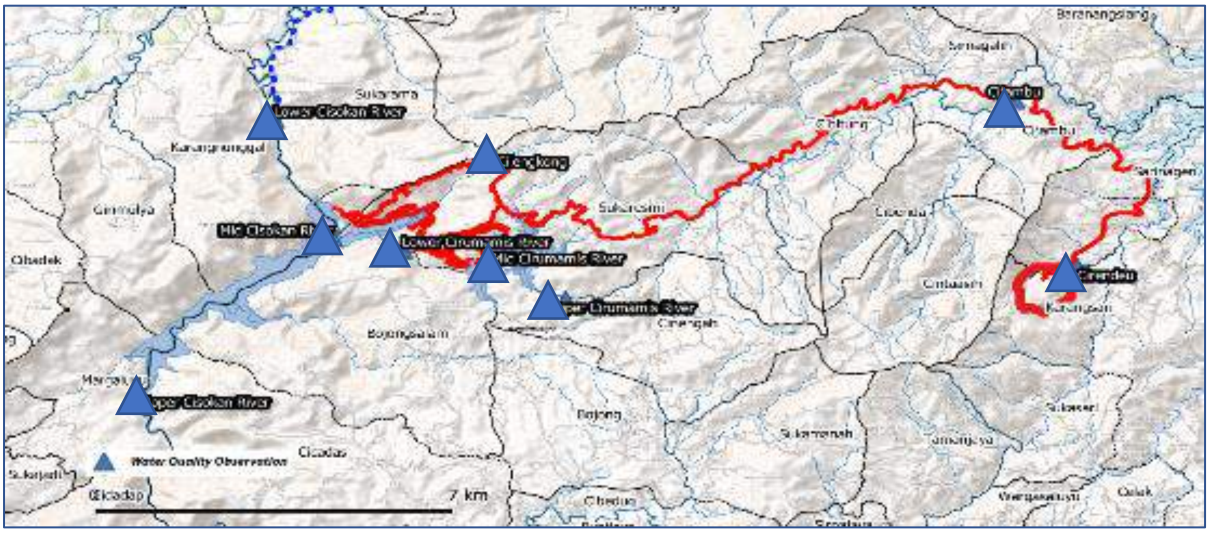


Figure 75. Location of Water Quality Observation Points (blue triangles)

The parameters monitored refer to the quality standards of West Java Regional Regulation Number 39 of 2000 concerning water designation and water quality standards for the Citarum River and its tributaries in West Java. The results of water quality measurements in the Cisokan River and several tributaries are generally still below the established quality standards. Measurement of river water quality in the project area is carried out twice a year, this is to obtain an overview of the condition of surface water quality for one year, namely at the beginning of the rainy season and the beginning of the dry season. Two data from water quality measurements are averaged to obtain the annual average value for each sampling location. In detail, the average water quality from 2012-2019 surface water of the Cisokan River and several of its tributaries is presented in Table 24.

Table 24. Average Water Quality in Rivers Around UCPS. Orange colours indicate parameters that locally exceed the government thresholds

Parameters	Unit	Standard	Cireundeu	Cilengkong	Cijambu	Upstream Cisokan	Down-stream Cisokan	Upstream Cirumamis	Down-stream Ciru-mamis
Physical Parameter									
Turbidity	NTU	-	10	17.505	95.03	126.34	131.39	258.655	244.9
Temperature	C	-	26,1	26.9	25.75	26.65	26.6	27.45	26.95
Air Temperature	C		-	30.45	29.3	30.75	30.75	31	31

Parameters	Unit	Standard	Cireundeu	Cilengkong	Cijambu	Upstream Cisokan	Down-stream Cisokan	Upstream Cirumamis	Down-stream Ciru-mamis
Color	PtCo	-	-	15	32.5	15	22.5	20	15
Total Suspended Solids (TSS)	mg/ L		7,6	114.5	31	532	141.5	29.5	28.5
Total Dissolved Solids (TDS)	mg/ L	1000	192	117	202	174.5	448	498	2209
Electrical Conductivity	us/c m	2250	-	169.255	261.4	144.45	120.5	161.9	327.15
Chemical Parameter									
Mercury (Hg)	mg/ L	0.001	-	0	0	0.0071	0	0.27	0
Phospat Dissolved	mg/ L		-	0.044	0.04	0.038	0.078	0.140	0.799
Amonia (NH3)	mg/ L	0.02	-	0.056	1.514	1.308	1.030	1.232	1.364
Nitrogen Total	mg/ L		-	3.8	3.45	4.2	3.2	3.2	3.95
Arsen (As)	mg/ L	0.05	-	0	0.0002	0.0036	0.0006	0.0016	0.0011
Barium (Ba)	mg/ L	1	-	0	0	0	0	0	0
Iron (Fe)	mg/ L	5	-	0.099	0.565	0.84	0.56	1.977	1.991
Boron (B)	mg/ L	1	-	0.0811	0.081	0.138	0.177	0.101	0.292
Flourida (F)	mg/ L	1.5	-	0.574	0.538	0.603	0.425	0.370	0.579
Cadmium (Cd)	mg/ L	0.01	-	0.039	0.026	0.035	0.034	0.030	0.181
Chlorida (Cl)	mg/ L	600	3,96	61.93	75.03	63.35	62.21	62.95	75.755
Chlorine (Cl2)	mg/ L	0.003	-	0.06	0.255	0.16	0.16	0.045	0.52
Cobalt (Co)	mg/ L	0.2	-	0.011	0.016	0.016	0.0162	0.018	0.017
Chromium Valensi 6 (Cr)	mg/ L	0.05	0,01	0.0062	0.01115	0.0084	0.02745	0.0164	0.037
Mangan (Mn)	mg/ L	0.5	-	0.046	0.044	0.079	0.028	0.036	0.431
Natrium (Alkali) (Na)	mg/ L	60	-	0	9.57	7.14	7.2	7.27	6.62
Nikel (Ni)	mg/ L	0.5	-	0	0	0	0	0	0
Nitrat (NO3 - N)	mg/ L	10	1,8	4.431	3.424	3.186	2.956	3.254	7.694
Nitrit (NO2 + N)	mg/ L	0.06	-	0.149	0.158	0.097	0.085	0.095	0.048
Dissolve Oxygen (DO)	mg/ L	>=3	-	3.365	3.675	4.205	4.165	4.575	3.71
pH	mg/ L	6-9	7,06	7.62	7.9245	7.941	7.9105	7.82	7.708

Parameters	Unit	Standard	Cireundeu	Cilengkong	Cijambu	Upstream Cisokan	Down-stream Cisokan	Upstream Cirumamis	Down-stream Ciru-mamis
Selenium (Se)	mg/L	0.01	-	0	0.0015	0.001	0.0025	0.0035	0.003
Seng (Zn)	mg/L	0.02	0,03	0.13	0.061	0.038	0.214	0.083	0.045
Sianida (Cn)	mg/L	0.02	-	0.006	0.016	0.0275	0.005	0.005	0.0165
Sulfat (SO4)	mg/L	400	-	0	26.26	12.82	8.151	6.28	10.052
Sulfida (H2S)	mg/L	0.1	0.09	0.305	0.232	0.0372	0.01335	0.02295	0.0507
Copper (Cu)	mg/L	0.1	-	0.010	0.012	0.011	0.023	0.009	0.078
Lead (Pb)	mg/L	0.1	-	0.160	0.254	0.030	0.043	0.053	0.125
Hardness Total (CaCo3)	mg/L		-	85.72	157	213.36	150.104	137	193.08
Phenol	mg/L	0.02	-	0	0.274	0.3	0.155	0.2	0.2
Oil and Fat	mg/L	0	-	2	1.835	2.335	2	2.5	1.5
Methylene Blue Active Compound	mg/L	0.5	-	0	0.03	0.09	0	0.055	0
BOD	mg/L	6	1,45	25.715	25.77	28.6	19.965	15.85	19.8
COD	mg/L	10	30,31	46.122	46.136	76.724	43.107	41.366	50.185
Detergent (MBAS)	mg/L	0	-	0.2079	0.22	0.205	0.23515	0.145	0.165
Microbiology Parameter									
Fecal Coliform	Jml/1000 ml	2000	-	124.5	472.5	757	1157.5	861.5	561.5
Total Coliform	Jml/1000 ml	10000	-	507	1381.5	2171.5	2169.5	1335	1342

Standard: West Java Governor Decree No. 39 year 2000

The results of the measurement of water quality physical parameters show that all sample locations or water bodies in the project area are below the quality standard set by the Governor of West Java, however, there are parameters that have a value greater than the quality standard, for example: TSS. As for water quality based on chemical parameters, almost all of them showed lower values except for BOD, COD and DO values which indicated pollution had occurred because they were above the quality standard.

The results of the surface water quality analysis of several rivers whose water samples were generally below the quality standard, however, there were some that were above the quality standard, especially with regard to the key parameters of domestic waste. Key parameters with regard to domestic waste include COD, BOD, TSS.

The results of the BOD and COD analysis show that the BOD and COD values have exceeded the quality standards set for all measurement locations (Figure 76), but in detail there are fluctuations every year and there are several measurements below the quality standard. In detail, the graph of the BOD contamination values in water bodies in several river flows in the UCPS Cisokan area on average between 2012-2019 is presented in Figure 77.

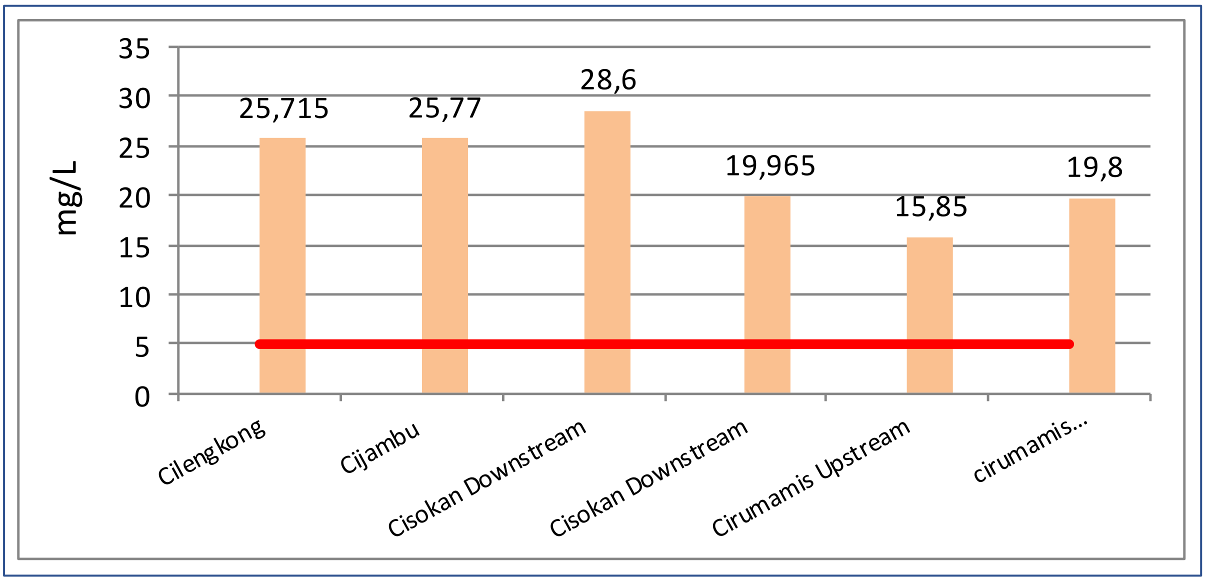


Figure 76. Average value of BOD Contamination in different river areas

The results of the surface water quality analysis at the project site show that BOD in the Lower (Downstream) Cisokan River shows the highest BOD content, even though all observation points are above the quality standard (Figure 77).

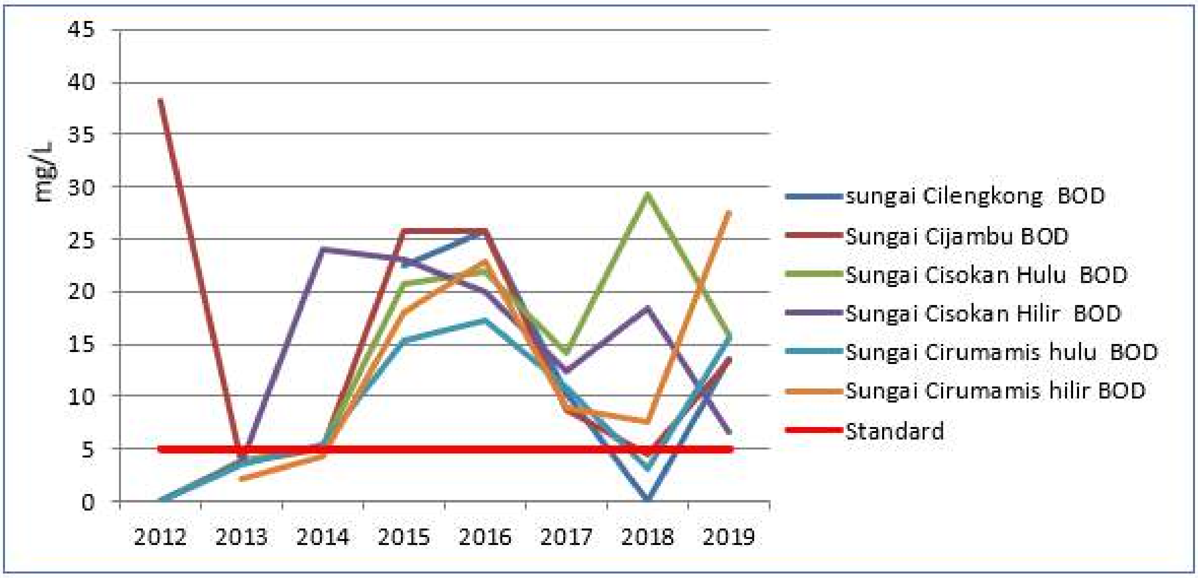


Figure 77. Annual fluctuations in BOD Value between 2012 and 2019 on the River in the Study Area

The results of river water quality analysis for BOD parameters show that all rivers are above the BOD concentration threshold required in the Governor's regulation. The highest average BOD value is found in the Upper Cisokan River. The high BOD values are likely caused by organic waste material primarily from domestic waste and fertilizer run off. This condition shows that domestic waste management has not been managed properly, including the provision of toilets and the culture of disposing of waste into rivers is still quite large.

The value of COD contamination in the river body around UCPS in relation to the government benchmark is shown in Figure 78.

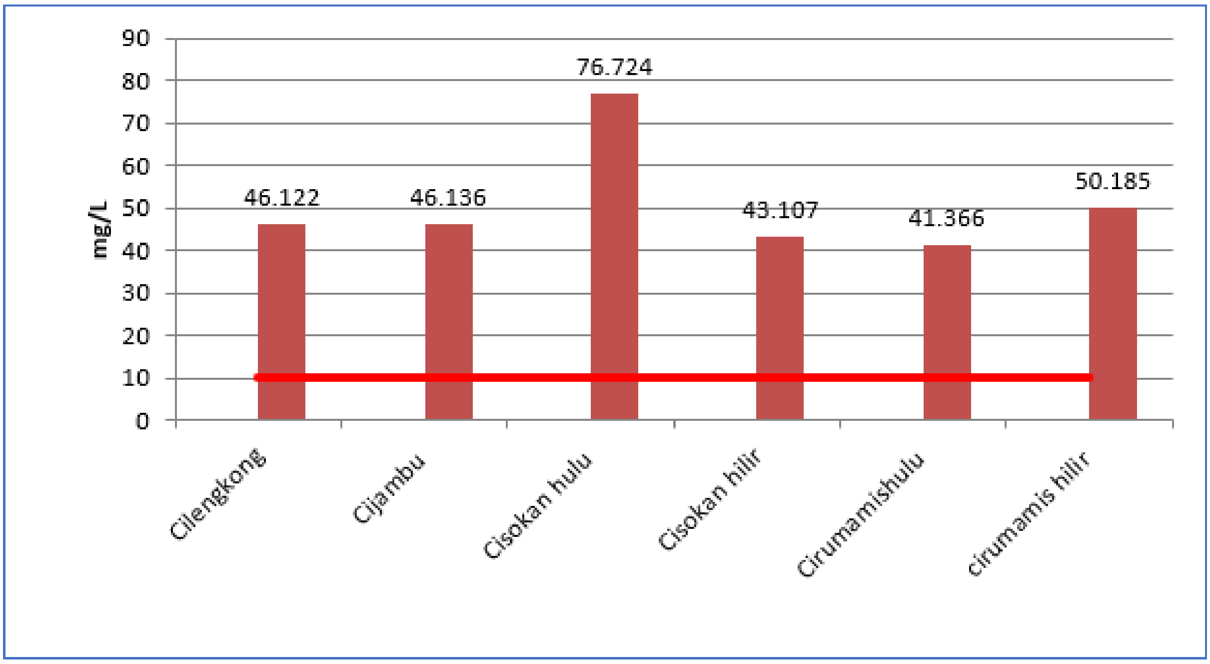


Figure 78. Value of COD in the River Basin Around UCPS

Graph of COD values for each measurement from 2012-2019 in the rivers around UCPS is shown in Figure 79.

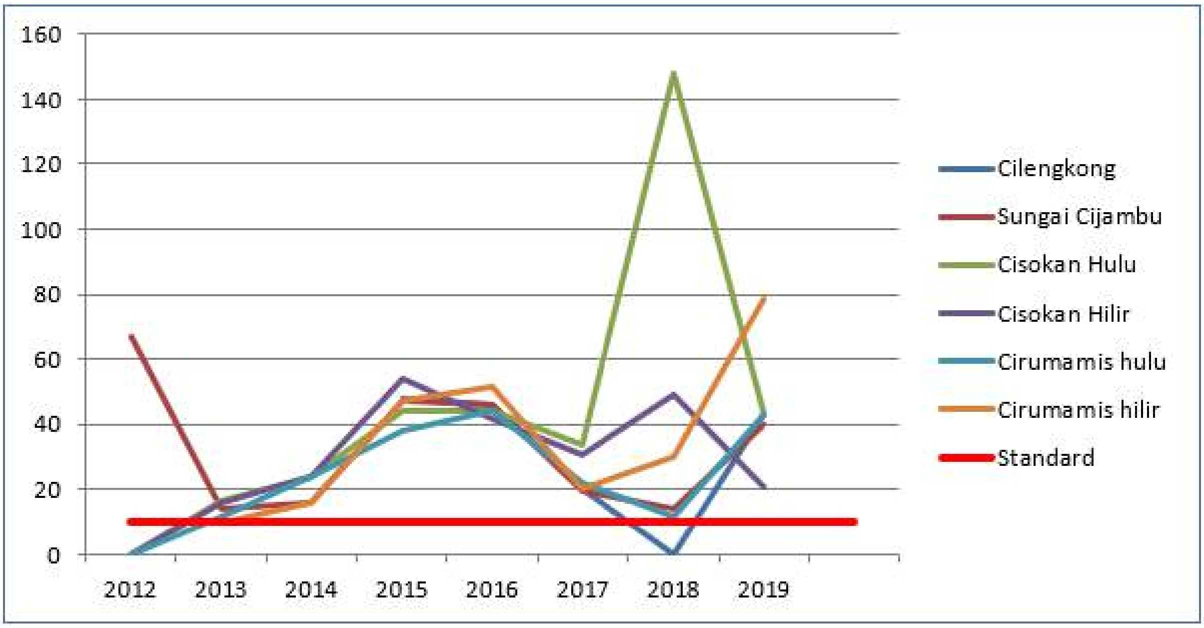


Figure 79. COD Value for 2012 - 2019 on the River in the Study Area

The parameters of BOD and COD during the years 2012-2019 showed fluctuations in the values of all rivers in the study area. From 2015 to 2016, the values of BOD and COD in all rivers increased until they exceeded the established quality standards. The value falls again and then fluctuates again. Dissolved oxygen (DO) content 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 the quality standard, the better the condition of the waters in the area. The guideline belonging to the West Java Provincial Government states that the required value of dissolved oxygen is more than 3. In detail, the DO value graph is presented in Figure 80.

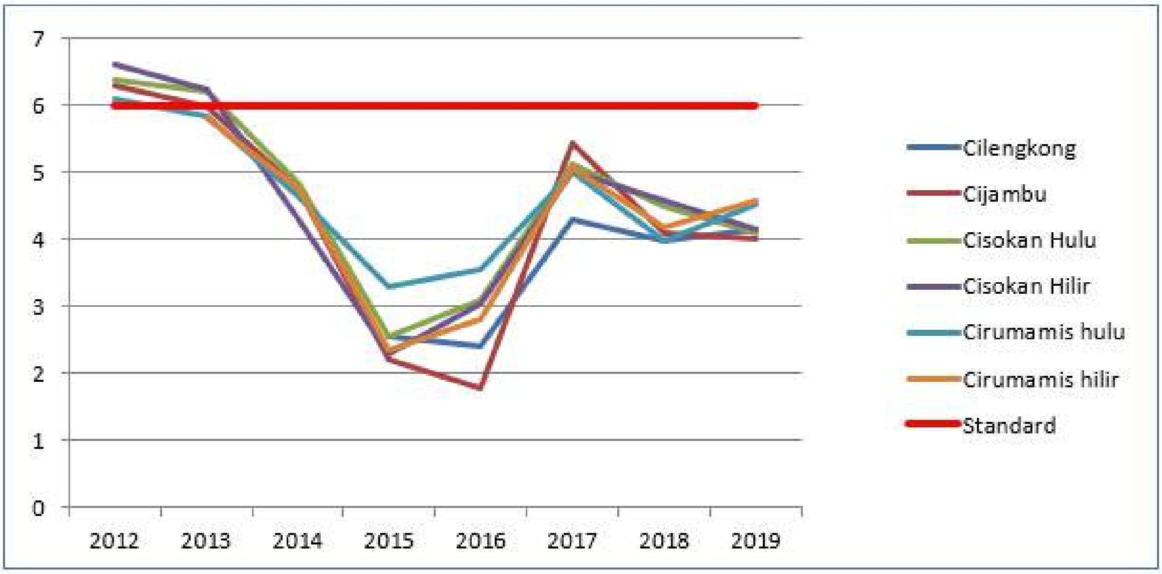


Figure 80. Dissolved Oxygen Value 2012 - 2019 in the River in the Study Area

Figure 80 shows that the Dissolved Oxygen value is generally still above the minimum threshold, but generally has a downward trend. In 2015 and 2016 the Dissolved Oxygen value was below the threshold, this was greatly influenced by the waste flowing into water bodies, especially domestic waste, this could be seen from the high BOD and COD values. High BOD and COD values indicate low Dissolved Oxygen values, because Dissolved Oxygen availability is used for microorganism metabolism.

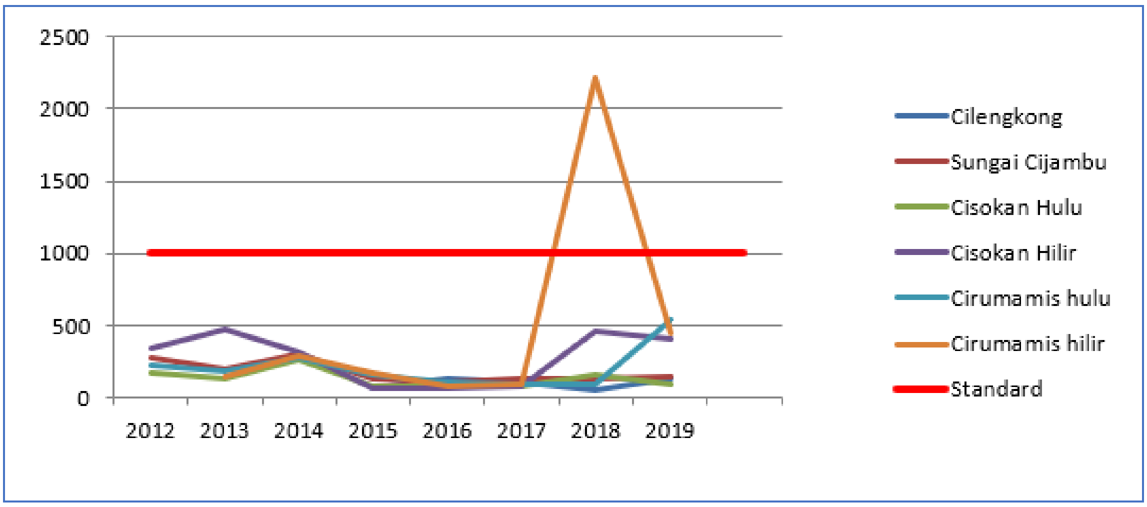


Figure 81. Observations of Dissolved Solids Values 2012-2019 in the River Around the Project Area

The value of Total Dissolve Solids (TDS) or total dissolved solids indicates the amount of salt and minerals that dissolve in water. The results of environmental monitoring for 2012-2019 show that the level of dissolved solids in several rivers in the study area is mostly below the quality standard set by the West Java Provincial Government (Figure 81).

The results of the TDS measurement show that in 2018 semester II (November measurement) the TDS value was far beyond the quality standard threshold, this happened in the Lower Cirumamis River, but then came back below the set quality standard.

The 2011 EIA report stated that there were illegal gold mining activities near the study area. The results of monitoring of the mercury content in several rivers around the UCPS area showed that the mercury content in the Cirumamis and Cisokan rivers passed the quality standards set in 2013. The mercury content in the river strongly decreased in 2015-2017, until the results of monitoring in 2018- 2019 shows that the mercury content in the rivers in the study area has remained low (Figure 82).

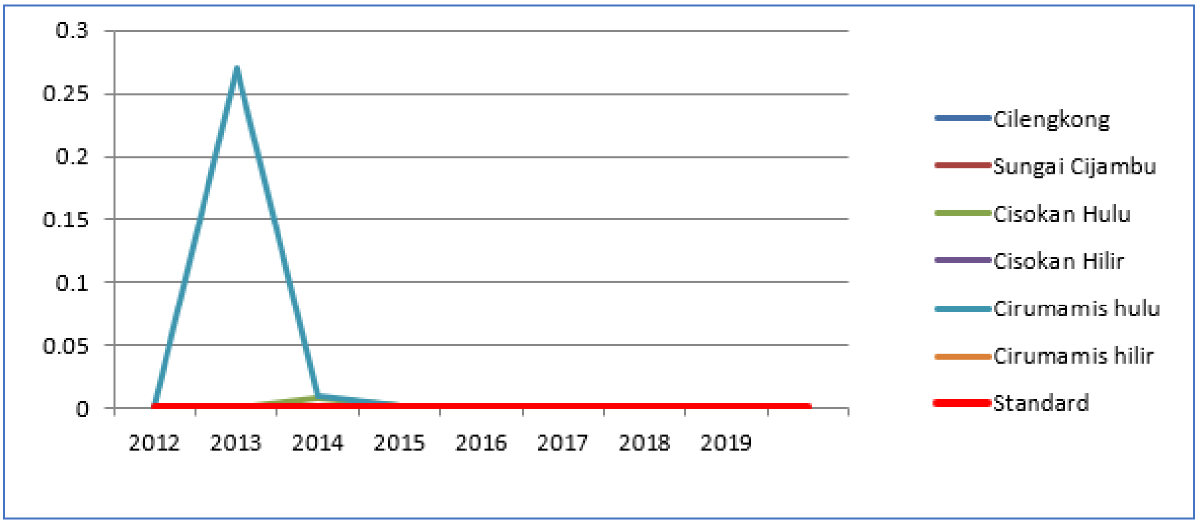


Figure 82. Observations of Mercury (Hg) Value 2012-2019 in the River Around the Project Area

Based on the results of the identification of the abundance of aquatic biota using the dominance index, it was found that the study location indicated that there had been mild-moderate-severe pollution. The level of contamination depends on the dominance index value of each parameter. The parameters used in calculating the dominance index are plankton, phytoplankton, and benthos. The phytoplankton dominance index shows that the sample location is still in a light polluting condition, but if the analysis uses the Bantos approach, the study location is included in the moderate-heavy category. This was possible because the sampling method/ technique used did not match the characteristics of the location. The level of pollution based on the abundance of aquatic biota using the dominance index is shown in Table 25.

.

Table 25. Pollution Level based on the Dominance Index of Aquatic Biota

River name	Parameters	Year								min	max	average	Conclusion on pollution level
		2012	2013	2014	2015	2016	2017	2018	2019				
Cilengkong	Phytoplankton				0.455	0.894	0.8085	0.891	0.8535	0.215	0.916	0.5655	moderate
	Zooplankton				0.7495	0.7865	0.44	0.79	0.859	0.082	0.938	0.51	moderate-heavy
	Plankton				0.287	0.4905	0.127	0.082	0.8875	0.063	0.918	0.4905	moderate-heavy
	Bentos				0.693	1.649	1.0125	1.332	1.43	0	1.748	0.874	mild
Cijambu	Phytoplankton		0		0.41	0.779	0.7835	0.8175	0.869	0	0.918	0.459	moderate-heavy
	Zooplankton		0		0.41	0.779	0.7835	0.8175	0.869	0	0.918	0.459	moderate-heavy
	Plankton		0.76		0.32985	0.491	0.0845	0.069	0.904	0.066	0.938	0.502	moderate-heavy
	Bentos		1.543		0.693	1.4925	1.0935	1.512	1.43	0	1.543	0.7715	moderate
Upstream Cisokan	Phytoplankton		0.59		0.5421	0.8935	0.8405	0.9325	0.8965	0.215	0.935	0.575	moderate
	Zooplankton		0		0.7835	0.7425	0.8255	0.795	0.854	0	0.878	0.439	moderate-heavy
	Plankton		0.64		0.21095	0.486	0.0835	0.055	0.9235	0.055	0.927	0.491	moderate-heavy
	Bentos		0.994		1.1353	1.7145	1.359	1.325	1.04	0.6616	1.82	1.2408	mild
Downstream Cisokan	Phytoplankton		0.74		0.50985	0.8415	0.8885	0.8915	0.8405	0.215	0.91	0.5625	moderate
	Zooplankton		0.72		0.75685	0.747	0.823	0.9935	0.8195	0.639	1	0.8195	mild
	Plankton		0.79	1.9285	0.232	0.9045	0.0705	0.107	0.9045	0.064	0.931	0.4975	moderate-heavy
	Bentos		1.401		1.1353	1.077	1.3245	1.3305	1.1	0.6616	1.609	1.1353	mild
Upstream Cirumamis	Phytoplankton		0.66		0.5664	0.846	0.855	0.909	0.856	0.31	0.935	0.6225	moderate
	Zooplankton		0.5		0.5955	0.7565	0.7885	0.81	0.879	0.5	0.938	0.719	moderate
	Plankton		0.73	1.632	0.4155	0.488	0.098	0.067	0.899	0.055	0.9	0.4775	moderate-heavy
	Bentos		1.476		1.4453	1.728	1.1215	1.216	1.04	0.693	1.906	1.2995	mild
Downstream Cirumamis	Phytoplankton		0.61		0.6651	0.807	0.798	0.9115	0.843	0.594	0.92	0.757	moderate
	Zooplankton		0.67		0.632	0.7485	0.774	0.748	0.866	0.48	0.922	0.701	moderate
	Plankton		0.7		0.4775	0.4655	0.133	0.077	0.9075	0.077	0.925	0.501	moderate-heavy
	Bentos		1.543		0.693	1.286	1.127	0.865	1.1	0	1.561	0.7805	moderate

6.10 Erosion and Sedimentation

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

The calculation of watershed erosion-sedimentation, especially for erosion-sedimentation of the upper and lower dam, was carried out again in 2013 to obtain the predicted erosion-sedimentation that occurred. The sedimentation calculation is approximated by an erosion model from two watersheds that are similar and associated with sedimentation that occurs from the control watershed. The watershed used as a comparison is the watershed that flows into the Saguling reservoir. Observations in the control watershed and Cisokan Basin were erosion using the Universal Soil Loss Equation (USLE) erosion prediction (PLN-Geotrav Buanan Survey) and sedimentation using bathymetric measurements in the Saguling reservoir. The results of the analysis between erosion and sedimentation are made in the form of a graph of the relationship between erosion and sedimentation which is presented in Figure 83.

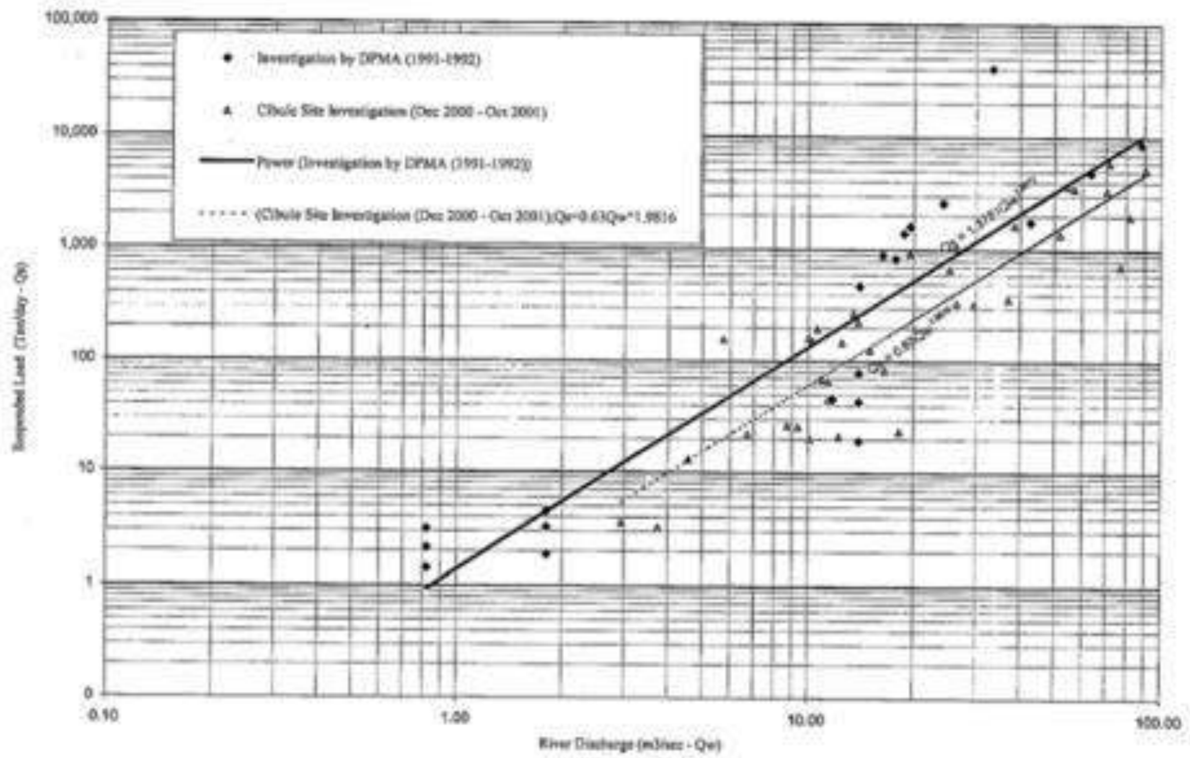


Figure 83. Relationship Between Sedimentation and River Discharge

Estimated analysis of soil erosion and sedimentation is carried out by considering factors of rainfall, soil erobility, slope, land use and land management using the USLE method resulting in an erosion rate of 1.643 mm/year.

The sedimentation rate in the sub-watershed locations around the Cisokan sub-watershed shows almost the same range, namely the Cihaur sub-watershed (0.199 mm/year), Citamiang sub-watershed (0.170 mm/year), Ciawitali 2 sub-watershed (0.118 mm/year) and Cibojong Sub-watershed (01,100 mm/year). The latest sedimentation and erosion data were approximated using bathymetric measurements in the Saguling Dam.

To mitigate more specifically on smaller land units, spatial modeling of the distribution of potential erosion at the project site points around the UCPS area was carried out. Modeling is done by overlaying several supporting maps to determine the rate of erosion and potential for erosion during the construction and operation of the project. In general, the existing erosion conditions in the project area are categorized as very light erosion. The distribution of erosion under existing conditions is presented in Figure 84.

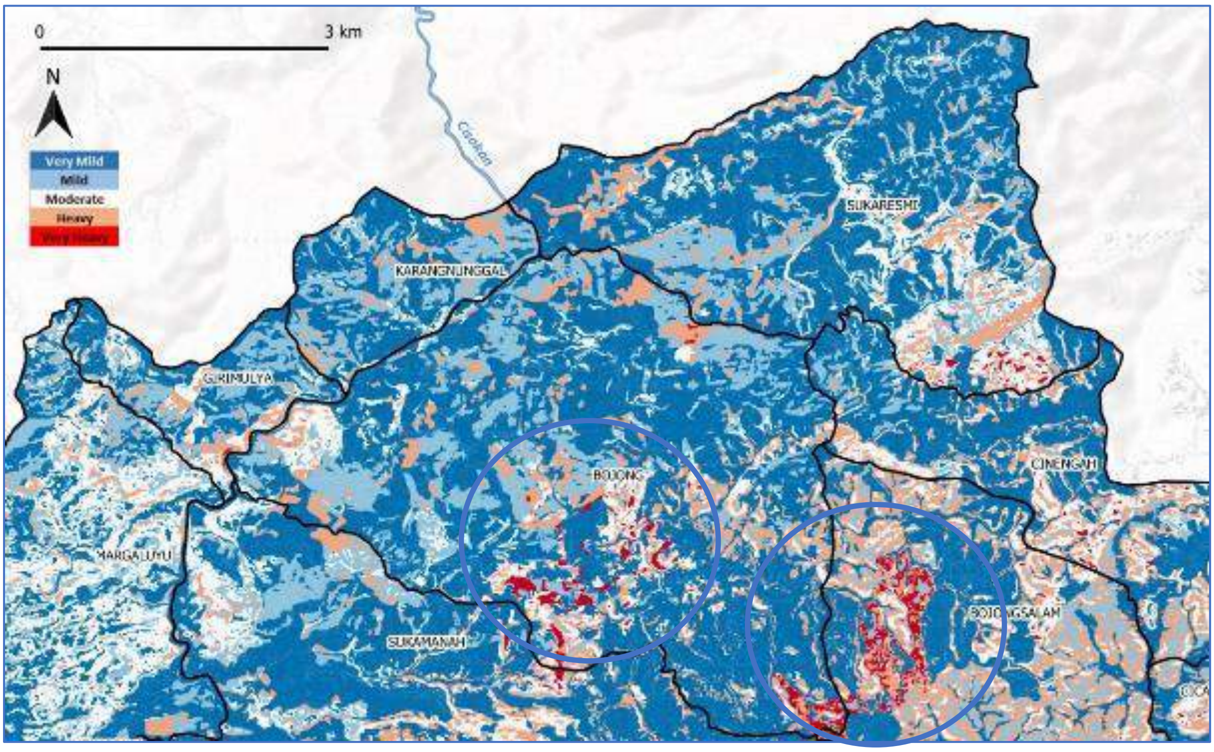


Figure 84. Existing Potential Erosion in the UCPS Project Area

6.11 Groundwater

6.11.1 Groundwater levels

Groundwater level measurements were carried out at several points at the UCPS site. Continuously measurements were made at 4 points in the area around UCPS, namely at Cibule hamlet, Karangnunggal Village, Cibima hamlet, Sukaresmi Village, Bojongpari hamlet Karangsari Village, Babakan hamlet Sarinagen Village. The measurement locations are shown in Figure 86.

Overall groundwater level data is obtained from UCPS monitoring documents, in the 2007 AMDAL and EIA 2011 documents, no water level data is available. The results of groundwater level monitoring at locations around UCPS are shown in Figure 87.

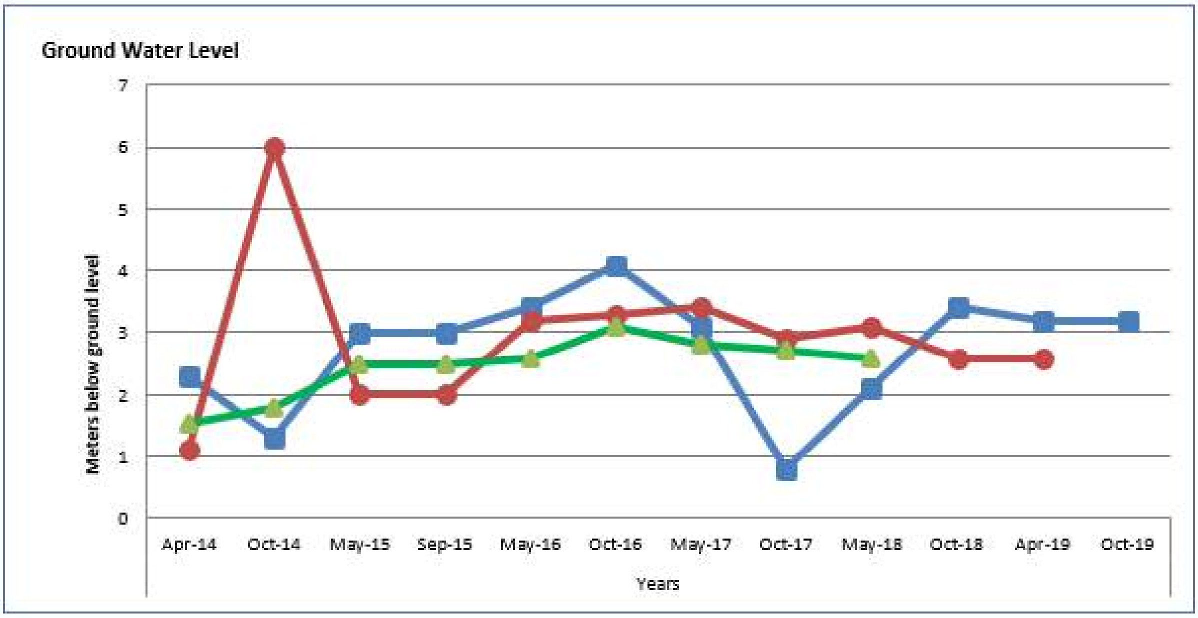


Figure 85. Groundwater Level Monitoring Results

In general, changes in the average groundwater level at all monitoring points at UCPS tend to fluctuate. However, in general the results of monitoring every 6 months show seasonal changes that occur less than 1 meter. Based on the monitoring results, it is known that the condition of the groundwater level is still relatively up and down every year, this means that the condition is still influenced by the natural conditions of the local area so that the construction of the new access road did not have a significant effect on the decrease in the quantity of groundwater.

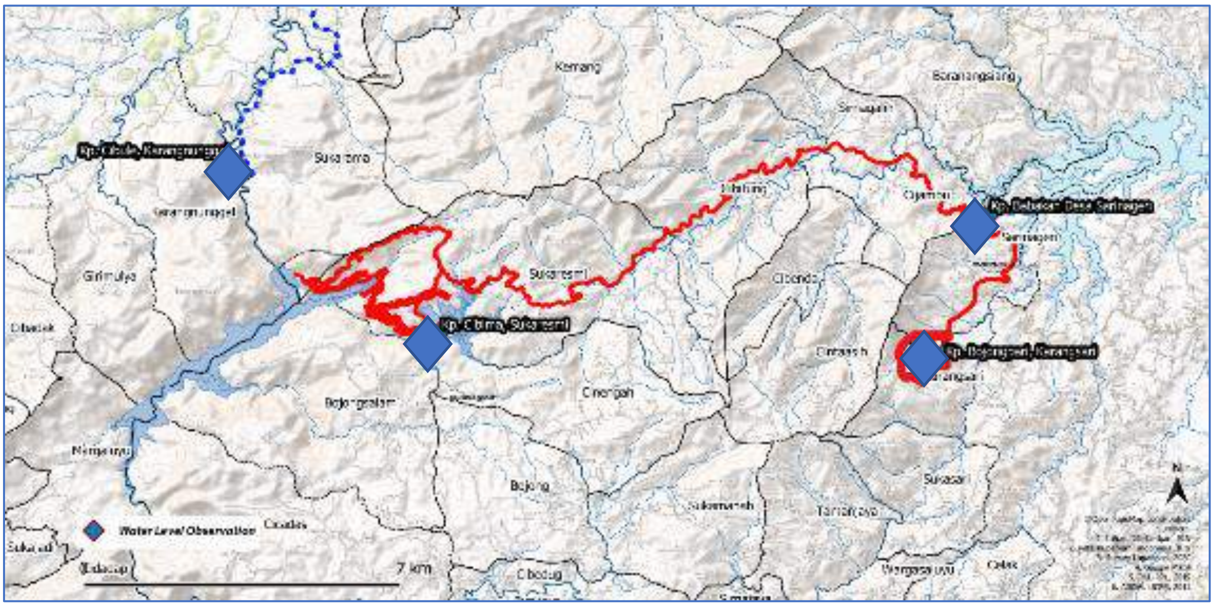


Figure 86. Groundwater Level Monitoring Location

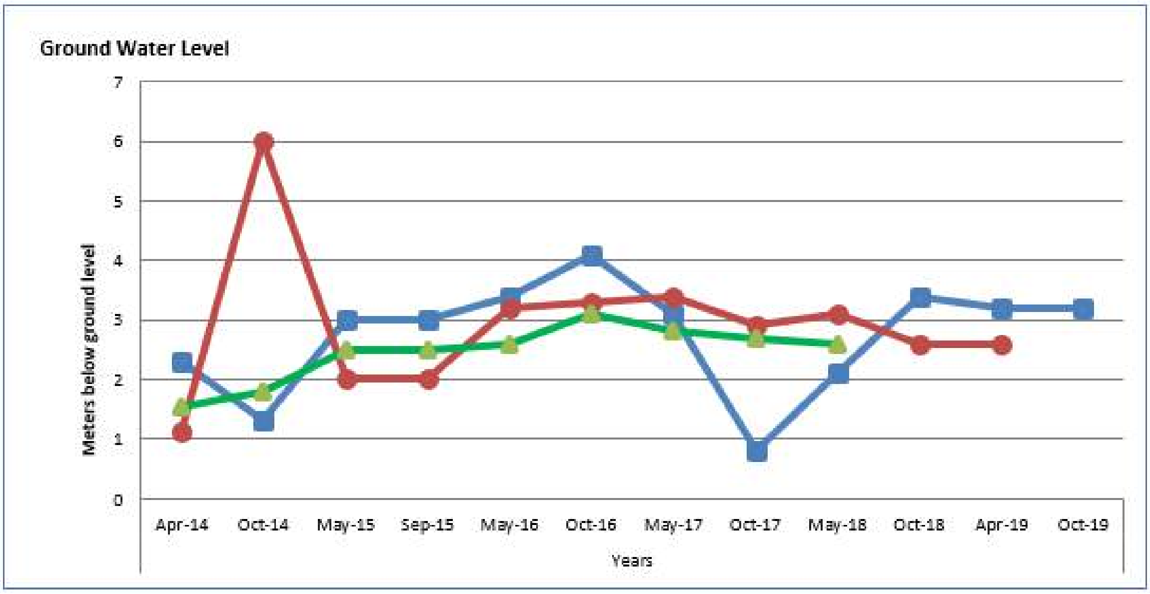


Figure 87. Groundwater Level Monitoring Results

The condition for the quantity of groundwater that is likely to be affected during the construction of UCPS is in locations close to water sources for project needs such as locations near workers' camps. So that monitoring efforts need to be carried out at these locations during project activities.

6.11.2 Groundwater Quality

Groundwater quality data were obtained from the 2007 UCPS PLTA ANDAL documents and monitoring reports up to 2019. In general, water quality monitoring is carried out twice a year at the locations of water wells around UCPS, but the changing monitoring locations cause not all locations to have trend data. The locations where groundwater quality measurements have been carried out are shown in Figure 88.

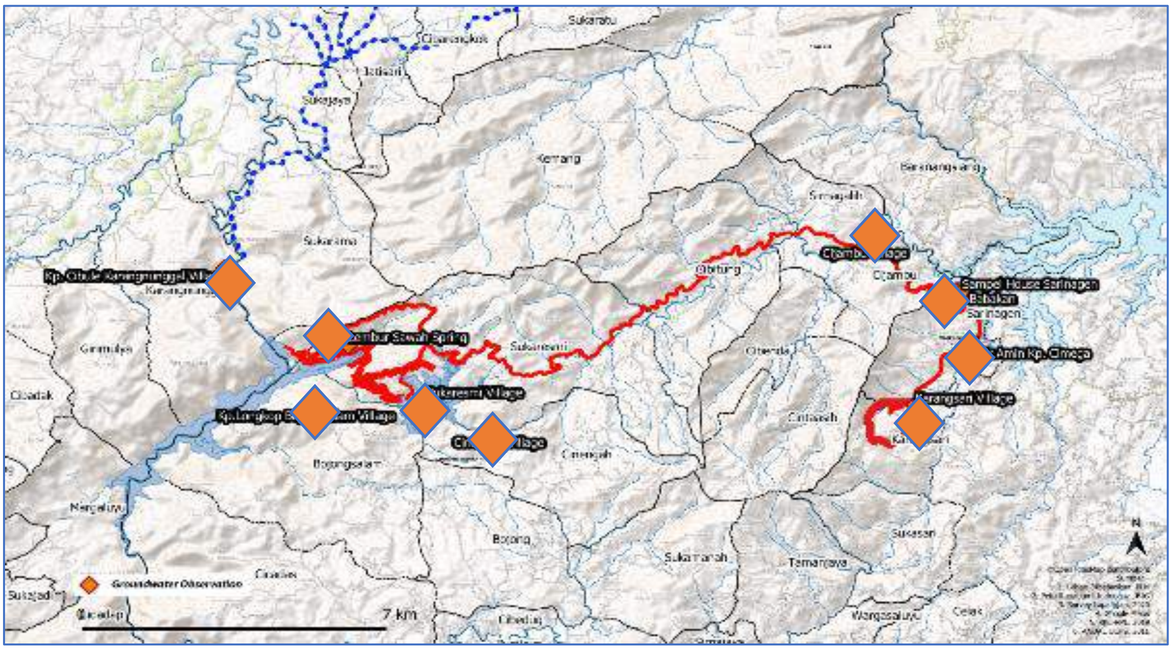


Figure 88. Groundwater Quality Sampling Locations

The results of water quality testing in Sukaresmi Village, Karangsari Village, Cijambu Village, Bojongsalam Village, Cinenga Village, and Karangnunggal Village in general for chemical parameters showed good conditions and were still below the Indonesian government standard. However, it was found that the level of turbidity was above the quality standard in the villages of Cinenga and Karangnunggal and the levels of total coliform were found that were above the quality standard in the village of Sukaresmi. The complete water quality conditions of each parameter are shown in Table 26.

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Table 26. Groundwater Quality at Several Monitoring Locations Around the UCPS Project Area. Orange colours indicate where the parameters exceed the threshold set by the government standard

Parameter	Unit	Standard (1)	Standard (2)	Sukaresmi Village	Karangsari Village	Cijambu Village	Kp.Longkop Bojongsalam Village	Cinenga Village	Kp.Cibule Karangnunggal Village
				2007	2010	2010	2013	2013	2013
				NewJec	Revisi Amdal,2011	Revisi Amdal, 2011	RKL-RPL	RKL-RPL	RKL-RPL
Physical									
Odor	-	Odorless	-		odorless	Odorless	Odorless	Odorless	Odorless
Dissolved Solid	mg/l	1000	-	390	344	360	123	63	295
Turbidity	NTU	5	-	0,61	0,8	12,5	2,28	6,57	5,45
Flavour	-	Tasteless	-	-	testeless	testeless	-	-	-
Temperature	C	Ambient Water Temperature ± 3°C	-	26	25	28,2	-	-	-
Colour	TCU	15	-	<5	2,38	27,78	-	-	-
conductivity	Us/cm	-	-	-	-	-	170,6	92,1	193,6
Chemistry									
Hg	mg/l	0,001	-	-	-	-	-	-	-
Arsenic	mg/l	0,05	0,01	-	-	-	-	-	-
Fe	mg/l	1	-	<0.02			0,38	0,75	0,72
Copper	mg/l	-	-	0,06	-	-	-	-	-
Fluoride	mg/l	1,5	-	0,006	-	-	0,09	0,21	0,29
Cadmium	mg/l	0,005	0,003	-	-	-	-	-	-
Chloride	mg/l	600	-	4,5	-	-	15,9	8,45	27,83
Chromium, val. 6	mg/l	0,05	0,05	<0.01	-	-	-	-	-
Mangan	mg/l	0,5	-	<0.005	-	-	< 0,006	< 0,006	< 0,006
Nitrat, N	mg/l	10	10	2,2	-	-	8,177	2,304	2,99
Nitrit, N	mg/l	1	10	0,001	-	-	< 0,004	< 0,004	< 0,004
pH	-	6 - 8	-	8,38	-	-	5,7	5,4	6,57
Selenium	mg/l	0,01	0,01	-	-	-	-	-	-

Parameter	Unit	Standard (1)	Standard (2)	Sukaresmi Village	Karangsari Village	Cijambu Village	Kp.Longkop Bojongsalam Village	Cinenga Village	Kp.Cibule Karangnunggal Village
				2007	2010	2010	2013	2013	2013
				NewJec	Revisi Amdal,2011	Revisi Amdal, 2011	RKL-RPL	RKL-RPL	RKL-RPL
Zinc	mg/l	15	-	0,2	-	-	-	-	-
Sianida	mg/l	0,1	-	-	-	-	-	-	-
Sulphat	mg/l	400		5,52			3,47	6,98	33,95
Pb	mg/l	0,05	0,01	-	-	-	-	-	-
Organic	mg/l	-	-	-	-	-	2,55	5,54	4,04
Sulfida	mg/l	-		0,006	-	-	-	-	-
Deterjen	mg/l	0,5					0,299	0,23	0,46
Kesadahan Total (CaCO3)	mg/l	-	-	-	-	-	70	54	169
Alumunium	mg/l	-	-	-	-	-	-	-	-
Nilai Permanganat (KMnO4)	mg/l	10	-	-	<0,03	<0,03	2,55	5,54	4,04
Sisa Klor	mg/l	-	-	-	-	-	< 0,1	< 0,1	< 0,1
Biological									
Total Coliform	MNP Index/100 ml	0	-	75	-	-	-	-	-
E.Coli	MNP Index/100 ml	-	-	-	-	-	-	-	-

*1) PerMenKes No: 416/Men-Kes/PER/IX/1990
2) Gov Japan Ministry of Environment Environmental Quality Standards for Groundwater Pollution

Table 27. Groundwater Quality at Multiple Monitoring Locations Around the UCPS Project Area (Continued)

Parameter	Unit	Standard (1)	Standard (2)	Example house Sarinangen Village						Engineering service office				Water springs Kp.Lembur Sawah	Mr.Amin Kp Babakan Cimega Village	Mr.Cahyo Kp.Cimega	Kp.Babakan Sarinagen Village
				2014		2015		2016		2017		2018		2019	2019	2019	2019
				May	Oct	May	Oct	May	Oct	May	Oct	May	OCt	Apr	Apr	Apr	Oct
Physical																	
Odor	-	odorless	-	=	Odorless	Odorless	Odorless	Odorless	Odorless	Odorless	Odorless	Odorless	Odorless	odorless	Odorless	odorless	Odorless
Dissolved Solid	mg/l	1000	-	344	240	200	290	300	150	215	215	89	250	362	112	340	16
Turbidity	NTU	5	-	0,02	0,067	0,63	2,38	2,99	0,67	0,55	0,62	4,12	1,03	1,55	64,5	3,83	0,54
Flavour	-	tidak berasa	-	Tasteless	Tasteless	-	-	-	-	-	-	-	-	-	-	-	-
Temperature	C	suhu udara ± 3°C	-	26,7	26,2	26	26,6	26,6	25,3	27	27,1	25,7	25,4	26,8	25,8	25,8	24,9
Colour	TCU	15	-	1	1	5	5	5	< 5	5	5	5	5	5	10	5	5
Daya Hantar Listrik	Us/cm	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chemistry																	
Hg	mg/l	0,001	-	< 0,004	<0.004	<0.02	<0.015	<0.0154	<0.0154	<0.01320	<0.0004	<0,0004	-	-	-	-	-
Arsen	mg/l	0,05	0,01	< 0,01	<0.02	<0.0194	<0.009	<0.00912	0,02285	-	-	-	-	-	-	-	-
Fe	mg/l	1	-	0,61	0,582	<0.1	1,56	2,5622	0,0966	<0.01693	<0.01639	<0,01693	<0,01693	<0,01693	0,29569	0,09982	<0.01693
Copper	mg/l		-	0,002	0,008	<0.005	1,17	1,188	0,0063	-	-	-	-	-	-	-	-
Fluorida	mg/l	1,5	-	6,8	6,89	8,07	7,75	7,481	7,21	<0.0072	2,2758	<0,0072	-	-	-	-	-

Parameter	Unit	Standard (1)	Standard (2)	Example house Sarinangen Village						Engineering service office				Water springs Kp.Lembur Sawah	Mr.Amin Kp Babakan Cimega Village	Mr.Cahyo Kp.Cimega	Kp.Babakan Sarinagen Village
				2014		2015		2016		2017		2018		2019	2019	2019	2019
				May	Oct	May	Oct	May	Oct	May	Oct	May	OCt	Apr	Apr	Apr	Oct
Cadmium	mg/l	0,005	0,003	0,003	0,003	-	-	-	-	<0.00159	0,00153	<0,00159	-	-	-	-	-
Chlorida	mg/l	600	-	< 0,008	< 0,008	0,18	<0.019	<0.01852	0,27	52,87	28,27	10,76	23,97	6,95	12,92		8,93
Chromium, val. 6	mg/l	0,05	0,05	< 0,05	< 0,05	<0.01	<0.024	<0.0240	<0.0240	<0.0032	0,0538	<0,0032	-	-	-	-	-
Mangan	mg/l	0,5	-	29,35	6,082	1,799	<0.089	<0.0895	1,8269	<0.01028	<0.01028	0,02616	0,1589	<0.01028	<0,01028	<0,01028	<0.01028
Nitrat, N	mg/l	10	10	< 0,003	< 0,003	<0.003	<0.025	<0.02495	<0.02495	0,0787	0,059	0,5639	0,1589	0,3287	12,1123	2	0,8701
Nitrit, N	mg/l	1	10	-	-	<0.005	<0.005	<0.0051	0,0078	<0.0034	0,011	0,01	0,0334	0,0065	0,0145	0,0577	0,019
pH	-	6 - 8	-	-	-	0,061	<0.014	<0.0138	0,0842	7,26	7,284	7,01	6,281	6,211	7,611	7,412	6,84
Selenium	mg/l	0,01	0,01	1,58	2,528	-	-	-	-	-	-	-	-	-	-	-	-
Zinc	mg/l	15	-	212	224	155,4	238,76	265,71	92	<0.01856	0,234	0,0338	-	-	-	-	-
Sianida	mg/l	0,1	-	-	-	-	-	-	-	<0.0050	<0.005	<0,0050	-	-	-	-	-
Sulphat	mg/l	400	-	-	-	1,9	8,69	9,99	4,42	30,2795	35,7446	15,4196	116,554	4,4574	82,8952	121,35	67,3678
Pb	mg/l	0,05	0,01	-	-	-	-	-	-	<0.00978	0,0434	<0.00928	-	-	-	-	-
Organic	mg/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulfida	mg/l	-	-	-	-	-	-	-	-	0,2756	<0.0021	<0.0021	-	-	-	-	-

Parameter	Unit	Standard (1)	Standard (2)	Example house Sarinangen Village						Engineering service office				Water springs Kp.Lembur Sawah	Mr.Amin Kp Babakan Cimega Village	Mr.Cahyo Kp.Cimega	Kp.Babakan Sarinagen Village
				2014		2015		2016		2017		2018		2019	2019	2019	2019
				May	Oct	May	Oct	May	Oct	May	Oct	May	OCt	Apr	Apr	Apr	Oct
Deterjen	mg/l	0,5	-	-	-	-	-	-	-	0,033	<0.0087	0,0214	-	-	-	-	-
Kesadahan Total (CaCO3)	mg/l	-	-	-	-	-	-	-	-	244,8	243,08	84,84	209,52	64,64	84	208	164
Alumunium	mg/l	-	-	-	-	-	-	-	-	-	-	-	0,5103	0,10531	0,38602	0,74346	0,11543
Nilai Permanganat (KMnO4)	mg/l	10	-	-	-	-	-	-	-	2,55	1,81	8,43	1,23	0,3	16,4	8,2	2,08
Sisa Klor	mg/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Biological																	
Total Coliform	MNP Index/ 100 ml	0	-	< 1,8	< 1,8	6	4	44	11	9	12	2	23	2,2	23	23	2,2
E.Coli	MNP Index/ 100 ml	-	-	-	-	-	-	-	-	<1.8	<1.1	<1.1	-	-	-	-	-

*1) PerMenKes No: 416/Men-Kes/PER/IX/1990
2) Gov Japan Ministry of Environment Environmental Quality Standards for Groundwater Pollution

Table 27 above shows the results of testing the quality of groundwater in the example house in the village of Sarinagen, the engineering service office, the springs in the village overtime, the houses of Mr. Amin and Mr. Cahyo, Cimega village, and in the village of Sarinagen. The measurement results showed that the chemical parameters in all locations were still below the quality standard. It was found that turbidity conditions were above the quality standard at the location of Mr Amin's well, Cimega Village. In addition, it was found that the total coliform value at each location was above the quality standard. The complete test results are shown in Table 27.

6.12 Biodiversity

The biodiversity section is prepared in accordance with the World Bank Environmental and Social Standard 6 (ESS6) Biodiversity Conservation and Sustainable Management of Living Natural Resources, ESF Guidance Note 6 Biodiversity Conservation, as well as relevant Indonesian laws and regulations. The International Finance Corporation (IFC) Performance Standard (PS) 6 was also used to provide guidance on identifying Critical Habitat triggers and assessment of offset requirements.

The objectives of ESS 6 are:

- To protect and conserve biodiversity and habitats.
- To apply the mitigation hierarchy and the precautionary approach in the design and implementation of projects that could have an impact on biodiversity.
- To promote the sustainable management of living natural resources.
- To support livelihoods of local communities, including Indigenous Peoples, and inclusive economic development through the adoption of practices that integrate conservation needs and development priorities.

The following sections outline the assessment of terrestrial and aquatic biodiversity values undertaken within the UCPS footprint area. Biodiversity surveys commenced in 2009 to establish the baseline but follow up surveys were conducted 2012, 2104, 2015 and 2020. The focus of the surveys was to:

- Determine presence of likely presence of aquatic and terrestrial biodiversity values that may trigger critical habitat (as defined under ESS6);
- Delineate the areas of natural and modified habitat according to the definition contained with ESS6; and
- Determine the existing ecological health/condition of aquatic and terrestrial biodiversity values and threats, including invasive alien species.

6.12.1 Regional Biodiversity Values

Indonesia is among the most biologically diverse nations on Earth, ranking third behind Brazil and Colombia in total species richness, and second in terms of endemic species (Mittermeier et al. 2005; Whitten et al. 2004). The country supports the third largest expanse of tropical forest in the world (behind Brazil and the Democratic Republic of Congo). It encompasses two of the world’s seven major biogeographic regions, two of the world’s 25 Biodiversity Hotspots, 21 of 238 Global Ecoregions (WWF) and 23 of the world’s 218 Endemic Bird Areas (BirdLife

International). Indonesia contains some 17% of all known species on Earth, including an estimated 11% of the world's plant species, 12% of its mammals, 16% of all reptile and amphibian species, 17% of birds and 25% or more of all fish species (Mittermeier & Mittermeier 1998).

Java Island is located in the south-west of the Malayan Archipelago, an area of extremely high levels of species diversity in the contact zone between Australasian and Indomalayan biological regions. Some 6,500 species of plant have been reported on Java, of which 4,500 are native to the island, and some 325 only occur on Java, i.e., they are endemic to the island (Whitten et al. 1996). Some of the rarer and many endemic plants have only been collected once and their status in the wild is poorly known, making it hard to develop and implement effective conservation programs for protecting them.

Java is also rich in animal species, although not as rich as during the Pleistocene when a varied fauna existed that included dirk-toothed cats, pygmy hippopotamuses, and a range of elephant-like species (Louys & Meijaard 2010). Still, a rich fauna remains with a wide-variety of mammal species, many of which are endemic to the island, birds, reptiles, fish and amphibians, as well as numerous invertebrate species. A count of these vertebrate species in 1996 totaled 864 species on Java (Whitten et al. 1996), but since then many new species discoveries and taxonomic revisions have added a considerable number and the total is now close to 1,000 species.

Java mostly consists of a long chain of volcanoes which have created some of the most fertile soils in the South-East Asian region. The island therefore has a long history of agricultural use and it supports some of the highest human population densities in the world. This high population density and demand for agricultural land has resulted in high deforestation rates. Especially lowland and coastal forests have been targeted and few such stands now remain. Presently only about 1.1 million hectares of forest remain on Java (Prasetyo et al. 2013), covering about 7% of the land area. Most of these forests, like those in Cisokan, are at high elevation.

Because most species on Java are ecologically associated with or dependent on forests, the island's high deforestation rates are a major threat to its species. In addition, collection and hunting pressure is also high. With 58% of interviewed households on Java having had a cage bird in the past 10 years, and most birds being obtained from the wild (Jepson & Ladle 2009), it is obvious how high the collection pressure is in Indonesian forests. This also includes mammal species, such as pangolins, and reptiles such as the common gecko, which are both highly valued for the medicinal trade, and increasingly rare in the wild (Meijaard & Achdiawan 2011). Thus, there are few forests on Java that remain pristine and with a complete fauna. As a result, there are presently 44 species on Java listed as Critically Endangered or Endangered on the IUCN Red List of Threatened Species, the global authority on species conservation needs.

6.12.2 Threatened species, protected areas and Key Biodiversity Areas of Java

The Integrated Biodiversity Assessment Tool (IBAT) was used to generate a list of protected areas, Key Biodiversity Areas, and threatened species of Java, focusing on those in the vicinity of the project area.

Java is a geologically old island and therefore has a significant number of endemic species. Java also has one of the highest human population densities of any regions in the world, which has resulted in significant impacts on these endemic and other species. IBAT lists 30 Critically

Endangered terrestrial and freshwater species that occur on Java and 51 Endangered terrestrial and freshwater species. Other Critically Endangered and Endangered species occur in marine habitats but are unlikely to be affected by the Upper Cisokan Pump Storage project. IBAT also list 69 restricted range species occurring in terrestrial and freshwater environments of Java. Many of these species are restricted to mountainous areas and have not been identified in surveys in Cisokan.

There are no protected areas and Key Biodiversity Areas in the immediate vicinity (10 km) from Cisokan, but within a 50 km radius there are 23 protected areas, 8 Key Biodiversity Areas and 1 Alliance for Zero Extinction area. The Gunung Masigit-Kareumbi Key Biodiversity Area is the closest to the project area, at a distance of about 20 km south of the project site. The small (0.21 km²) Cadas Malang Nature Reserve lies at a distance of ca. 15 km to the south-west of the project site. This area was designated as a conservation in 1919 for the protection of its specialized flora. The large Gunung Gede Pangrango National Park lies some 30 km north-west of the project area (Figure 89).

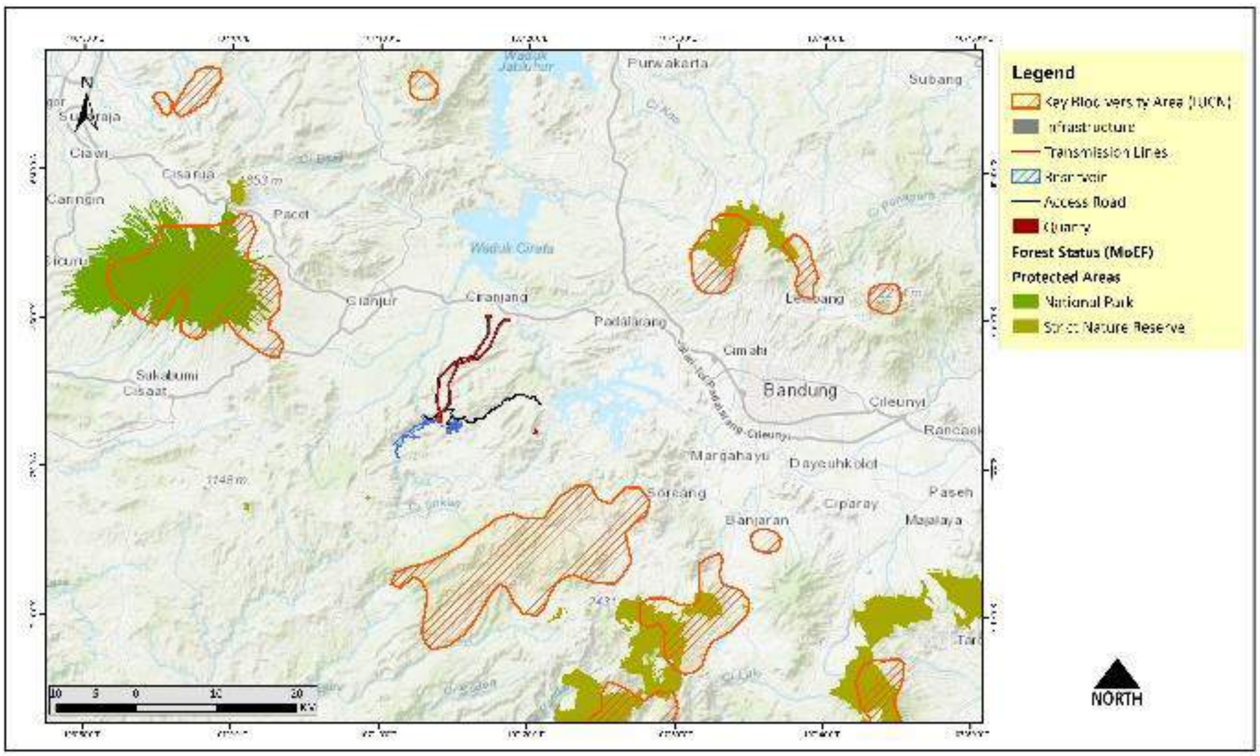

Figure 89. The UCPS project area in relation to protected areas and Key Biodiversity Areas

6.12.3 Floral Biodiversity

The vegetation type survey has been conducted since 1995. The most comprehensive survey is a survey conducted by Rahmat (2009). Based on field observations, 226 plant species were found from around 69 plant families. The access road location has the highest number of plant species, namely 173 species, quite large compared to the mining area, which has the least number of plant species, namely 86 species. The access road has various habitats along the track, while in the quarry area, forest vegetation has been clearing for a long time and is now dominated by grass and shrubs. No rare or protected plants were found during the survey period whereas, laurel (*Eugenia polyantha*), sweet magnolia (*Magnolia glauca*), manglid (*Magnolia blumei*), and kitambaga (*Eugenis cuprea*) were rarely encountered under land use stress. The most intact and diverse native vegetation community is the secondary forest at the Cirumamis River's location.

Based on the 2019 vegetation survey results at the research location, the plant composition of 135 plant species from 54 families was obtained (see Appendix F for full species list). Vegetation communities obtained per study location are 113 types on existing roads, 116 types on access roads, 90 types on lower dams, and 70 types on upper dams. Of the four locations, the highest number of plant species was at the access road location, namely 116 plant species. This number means that the access road's study location is still in good condition and supports the vegetation's life. The number of plant species was obtained per category from the total locations, namely tree category with 25 plant species, 45 plant species for pole category, 47 plant species for saplings, 28 plant species for saplings with 40 types of ground cover. This number shows that in the research location, there is still a complete vegetation community structure.

The 2019 vegetation survey identified several plant species that are included in the IUCN Red List conservation status (see Appendix F). From the monitoring of vegetation communities in all study locations, 4 species with conservation status Least Concern (LC) were identified. The vegetation in the UCPS area is dominated by common and introduced species but one Endangered species (Rosewood) and one Vulnerable species (Merkus's Pine) were identified in the UCPS area.

Tree species found along the transmission line route include Bamboo (*Bambusa* sp.), Albasiah (*Paraserianthes falcataria*), Mahogany (*Switenia mahagony*), Mindi (*Melia azaderachta*), Teak (*Tectona grandis*), Kihiang (*Albizia procera*), Saga (*Adenanthera pavonina*), Suren (*Toona sureni*), and Tisuk (*Hibiscus macrophyllus*). While the many non-timber groups found on the transmission line are: Banana Plants (*Musa paradisiaca*), Snakefruit (*Salacca edulis*), Coffee (*Coffea* sp.), Sugarpalm (*Arenga pinnata*), Durian (*Durio zibethinus*), Jengkol (*Pithecelobium jeringa*), Jackfruit (*Artocarpus integra*), Petai (*Parkia speciosa*), Vanilla (*Vanilla* sp.).

6.12.4 Faunal Biodiversity

Mammals found directly in the 2012 survey were Small Indian Civet (*Viverricula malaccensis*), Squirrel (*Tupaia* sp.), and Rats (*Rattus* spp.), While other types of mammals obtained from local community information were wild boar (*Sus scrofa*) and Oriental Small-clawed Otter (*Aonyx cinerea*). Meanwhile, the 2020 field survey identified 16 species of mammals around the Transmission Line and 11 of them have high conservation value. According to the Ministry of Environment and Forestry Regulation No. P. 106 in 2018, six types of mammals are included in the protected species.

According to the IUCN Criteria, there are as many as six species of important mammals. Two species are categorized as Critically Endangered (CR), which means that they have the highest threat of extinction. Two types are included in the Endangered (EN) category, which means the species with the second-highest extinction threat level. The last two species which are vulnerable to extinction are categorized in the Vulnerable (VU) category.

According to the CITES criteria, there are as many as eight types of mammals with high conservation value. Two of these are included in the CITES Appendix I, which means that these types of mammals are considered very rare. Their use is only in cases of extraordinary nature (not for commercial purposes) and regulation. Strict regulations govern trade in this category. Three types of mammals are included in Appendix II of CITES, which means that this species is considered rare but can still be used on a limited basis through a quota and supervision system. The role of scientific authorities in the process of granting export and import permits is also crucial. As many as five species are included in Appendix III CITES, these mammals are considered very rare for certain countries/regions. Hence, they need to be protected from exploitation. In this category, scientific and management authorities play a significant role in the licensing process.

Several species with conservation status need attention, such as Oriental Small-clawed Otter (VU), Pangolin (CR), Grizzled Leaf Monkey (EN), Javan Langur (VU), Less (CR). The large number of mammals found is supported by the ecosystem's condition in the transmission line location, which currently tends to have no significant holes. Currently, the location of the Transmission Line is still good and supports the life of Mammals.

The reptiles identified in the 2012 survey included a protected species, the Flat-nosed Pit Viper (*Trimersurus puniceus*). Besides, there are also Flying Lizards (*Draco volans*), Chameleons (*Calotes jubattes*), and Lizards (*Mabuia multifasciata*). As many as 29 herpetofauna species were recorded during the survey at the Transmission Route location, which consists of four types of amphibians and 25 species of reptiles. Of the Amphibian class, the most recorded species composition came from the Dicroglossidae family, with two species. The Bufonidae Family and the Rhacophoridae Family are also recorded, each with one species.

For the Reptile class, from the snake's group, the composition of species recorded was mostly from the Colubridae family, with seven species; this was followed by the Elapidae Family of three types; and two types of family Pythonidae. Meanwhile, from the lizard group, the Gekkonidae family was the family with the most species records, namely four species; followed by the Agamidae Family with three types; There are two types of family Scincidae; as well as one type of Family Lacertidae and Varanidae each.

Avifauna found on the Transmission Line in the 2012 survey totaled 37 dominant species, with five protected bird species (see Appendix F). The 2020 field survey identified 55 types of avifauna from 23 families, of which 16 species have high conservation value because the five types of avifauna are protected according to the Ministry of Environment and Forestry Regulation No. P. 106 in 2018. Five types of avifauna are included in appendix II, while four types are endemic, namely those with limited distribution, and four types including migrant avifauna, where this type of migrant avifauna does not breed in Indonesia

One example of a protected type of avifauna included in the CITES appendix II and a migrant type is Oriental Honey-buzzard (*Pernis ptilorhynchus* Temminck, 1821). Meanwhile, Javan Kingfisher (*Halcyon cyanoventris* Vieillot, 1818) is an example of an endemic species avifauna which has limited distribution. There is as much as one type of avifauna recorded in this study that has never been recorded in previous studies, namely the Asian Brown Flycatcher (*Muscicapa dauurica* Pallas, 1811).

The abundance of avifauna species indicates that the transmission line area is still a good location for avifauna life. There are electrocution and collision risks which are discussed elsewhere, especially for migratory birds of prey and other large birds such as storks. There is a risk of displacement of the migratory swallows (*Hirundo rustica*) rest area to the transmission line from the current place around Ciranjang Market, although the risk is small and has not occurred at this time but needs to be watched out. Currently there is an existing transmission line (Saguling) but the displacement of bird is also not occurring. This because the warmer temperature in the existing bird rest area, the presence of crowds, and sufficient food sources, which are not found in the existing or future transmission line areas.

6.12.5 Aquatic Biodiversity

Broad studies on the macro invertebrate and fish communities have been undertaken that, along with the water quality data, provide a basic picture of the health of the aquatic environment and its ability to support a functioning ecosystem.

6.12.5.1 Macro invertebrates

Changes in water quality as a result of nutrients entering the aquatic environment will affect the life of plankton and benthos (i.e., communities of the stream bottom), which in turn influences the survival of fish and aquatic larvae. Furthermore, the abundance and diversity of benthos are useful bio-indicators of water quality, because different species have different sensitivities of the types and concentrations of pollutants. The low mobility of benthos and their rapid responses to environmental substances, makes it relatively easy to obtain, identify and analyze benthos as aquatic indicators compared to other organisms. Indirectly, the benthos indicators through their availability as food for fish and amphibians, become general indicators of water and habitat quality.

The river geomorphology, river flow and water quality data described in the earlier section on hydrology suggest that there should be reasonable habitat available for a wide range of macro-invertebrates, including beetles, mayflies, caddis flies, stoneflies, snails and mollusks, despite reduced water quality and sedimentation. The macro invertebrate samples from 2006 show poor representation of macro invertebrate communities at all seven water quality sampling sites. There were few individuals collected at each site (2 – 33), and low diversity of species (<6). The most abundant genera were snails, which are generally tolerant of poor water quality. Indicators of good water quality and healthy benthic habitat, such as mayflies, caddis flies and stonefly larvae, were present, but not abundant. The results of the abundance analysis of plankton, phytoplankton, and benthos using the dominance index indicated mild, moderate, or severe pollution depending on which indicator was used. The phytoplankton dominance index shows that the sample location is still in a lightly polluted condition, but if the analysis uses the benthos approach, the study location is included in the moderate-heavy category. This was possible because the sampling method used did not match the characteristics of the location. The level of pollution based on the abundance of aquatic biota using the dominance index is shown in the table below.

6.12.5.2 Plankton

The abundance of plankton varies in each river between 1320 and 4140 ind./L. These results are divided into 2 categories, namely oligotrophic waters in the Cijambu and Cilengkong Rivers, and the upstream parts of the Cirumamis and Cisokan Rivers, with plankton quantities of 1410-1830 ind/L. The oligotrophic category of less than 2000 ind/L also indicates that the waters are still clean and have not been polluted by nutrients (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. Meanwhile, the downstream Cirumamis and Cisokan Rivers are mesotrophic with a plankton abundance of 2610-4140 ind/L which means they have moderate levels of nutrient pollution, likely resulting from anthropogenic activities in downstream areas such as agricultural activities.

Table 28. 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
	Variety Index	**1,43**	**1,04**	**1,1**	**1,43**	**1,04**	**1,1**

Plankton consists of phytoplankton and zooplankton that float or move with the river flow, 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, which is related to the photosynthesis process, so that phytoplankton is more commonly found on the surface, 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. On the other hand, 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.

The plankton dominance index ranged from 0.87 to 0.92, indicating that at the location of the waters there is a dominant type of plankton. One of the groups that is predominant is Chrysophyta (golden algae) which is found in almost every location 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, and that the community may be ecologically unbalanced.

Benthos abundance ranged from 15-45 individuals / m2. 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 characteristics of upstream waters are better than downstream waters. The bottom of the upstream waters consists of bedrock, rock outcrops, boulders, silt and sand. These substrates are places where most macrozoobenthos are found because they provide shelter from currents (Meisaroh, et al, 2019). Meanwhile, downstream waters have a muddy sand substrate which is less suitable for macrozoobenthos as it is less well protected from currents (Koesbiono 1979). The low value of several parameters of water quality, likely related to human activities, is also thought to affect the level of abundance of macrozoobenthos (Meisaroh, et al, 2019).

The dominance index for benthos ranges from 0.28 to 0.38, which according to Odum (1993) indicates 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, suggesting stable environmental conditions and low ecological pressure in these waters.

6.12.5.3 Shrimp and Fish

Only one species of shrimp has been identified in the UCPS area, the river shrimp (*Macrobrachium rosenbergii*), which was found during river surveys in 2015 and 2016 in all river systems. This is a small part of the total of 20-30 shrimp species that could occur in Javan streams (Hernawati et al. 2020), but it is unclear whether this diversity was overlooked in the surveys (e.g., because of insufficient taxonomic knowledge of this group), or because indeed the shrimp diversity is low in the area. Additional surveys would be required to assess the diversity of this group, which includes the Endangered species *Macrobrachium poeti* and *M. leptodactylus* from West Java, which is listed as Extinct, as it hasn't been found in 30 years.

The initial fish surveys were conducted in 2009 by Rahmat (2009) who described 19 species. Subsequent surveys were conducted in 2012 with 15 species identified (LIPI, 2012), and more recently in 2020 a total of 17 species was found. When compared with the total number of freshwater fish species recorded on Java, which is 135 species, the location shows poor fish species diversity. The fish species found in Cisokan are all generally common in Java, and are often used for consumption by local people. Eighty percent of the fish species found in Cisokan are native to Java, with 20% being introduced, including Guppy (*Poecillia reticulata*), Green Swordtail (*Xiphophorus helleri*) and Green Terror Cichlid (*Aequidens rivulatus*). Some types of fish such as *Rasbora lateristriata* and *Hemibagrus nemurus* which are usually found in highland rivers, are difficult to obtain using fish sampling techniques (LIPI, 2012). The fish species were assessed for conservation status, and national protection status but none met any of these criteria.

Local species that are categorized as difficult to find should be carefully monitored, such as Semah Mahseer (*Tor douronensis*) (see 8.2.2. regarding the cultural importance of this species), and Asian Redtail Catfish (*Macrones nemurus*). These are local migratory species whose behaviour might be influenced by changes in riverbank habitats that flow to flooded rivers. A similarly low-density species, Hampala Barb (*Hampala macrolepidota*), was found in the 2009 study but not in the following 10 years, until in the 2020 field study it was again confirmed. This could indicate local population fluctuations because of changing river conditions or supra-annual dispersal of populations to different parts of the river system.

Tilapia, goldfish and catfish are categorized as food species and can live in a variety of habitats, including slow-flowing habitats, river and lake environments and environments with soft sediments. Catfish can also live in rice fields and hypoxic and muddy environments. Tilapia are included in the IUCN top list as the worst alien species to disrupt native species from their habitat. Other species, such as *Channa gachua*, are not native fish, but have a high tolerance for temperature and pH changes. Guppies prefer fast-flowing habitats, along with the Green Swordtail are categorized as non-native fish which are not a food source. Both fish are omnivorous and can survive on a variety of food sources.

In general, the fish species that occur in the UCPS area are potamodromous species (which migrate locally from freshwater to other freshwater). The only amphidromous species found are tilapia, which are species that migrate from freshwater to seawater during their lifetime, but not for hatchery. Species sensitive to river damming are catadromous fish that live in inland rivers and lay their eggs in the sea (for example, eels) and anadromous whose adults live in the sea and lay their eggs in the upstream of the river (e.g., salmon). These two categories of fish species are rarely found in rivers that empty into the Java Sea.

6.12.6 Critical Habitat, Natural Habitat and Modified Habitat Assessment

ESS 6 requires a differentiated risk management approach to habitats based on their sensitivity and values. ESS addresses all habitats, categorized as 'modified habitat', 'natural habitat', and 'critical habitat', along with 'legally protected and internationally and regionally recognized areas of biodiversity value' which may encompass habitat in any or all of these categories.

The relevant definitions are as follows:

- Project Area of Influence: is defined as the geographical area in which biodiversity may potentially be significantly impacted by the UCPS construction and operation activities. This area excludes the wider area which may be affected by cumulative impacts.
- Modified habitats are areas that may contain a large proportion of plant and/or animal species of non-native origin, and/or where human activity has substantially modified an area's primary ecological functions and species composition. Modified habitats may include, for example, areas managed for agriculture, forest plantations, reclaimed coastal zones, and reclaimed wetlands.
- Natural habitats are areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary ecological functions and species composition.

- Critical habitat is defined as areas with high biodiversity importance or value, including: (a) habitat of significant importance to Critically Endangered or Endangered species, as listed in the IUCN Red List of threatened species or equivalent national approaches; (b) habitat of significant importance to endemic or restricted-range species; (c) habitat supporting globally or nationally significant concentrations of migratory or congregatory species; (d) highly threatened or unique ecosystems; (e) ecological functions or characteristics that are needed to maintain the viability of the biodiversity values described above in (a) to (d).
- Restricted-range/ Endemic Species = Species with world distributions of less than 50,000 km2
- Migratory species = Any species or lower taxon of wild animals, in which a significant proportion of the members of the entire population or any geographically separate part of the population cyclically and predictably crosses one or more national jurisdictional boundaries.
- Congregatory Species = Species that gather in globally significant numbers at a particular site and at a particular time in their life cycle for feeding, breeding or resting (during migration). For the purposes of the assessment and as outlined within the IFC PS6 Guidance Note, the assessment of populations has occurred according to the Estimated area Of Occurrence (EOO) as outlined in the IUCN Red List.

6.12.6.1 Critical Habitat triggers

There are five criteria are that can be 'triggers' in that if an area of habitat meets any one of them criteria. That area, it will then be considered critical habitat irrespective of failing to meet any other criterion (Table 29). Therefore, critical habitat can be determined through a single criterion or where a habitat holds biodiversity meeting all five criteria. This approach is generally more cautious but is used more widely in conservation. Critical habitat criteria therefore have two distinctive characteristics. First, components of biodiversity are essentially assigned to only two levels of conservation significance, those that trigger critical habitat and those that do not. Second, each criterion is applied separately and not in combination, meaning that the scores are not cumulative. The assessment for critical habitat was undertaken as a screening process against the criteria defined within the IFC PS 6 Guidance Note, involving GIS analysis and desk-based data collection, including a review of previous biodiversity studies.

Table 29. Criteria that can trigger the identification of Critical Habitat and the thresholds that provide these triggers.

Criteria	Thresholds
Criterion 1: Critically Endangered (CR) / Endangered (EN) species:	(a) Areas that support globally-important concentrations of an IUCN Red-listed EN or CR species (0.5% of the global population AND ≥ 5 reproductive units of a CR or EN species)[7]; (b) Areas that support globally-important concentrations of an IUCN Red-listed VU species, the loss of which would result in the change of the IUCN Red List status to EN or CR and meet the thresholds in (a). (c) As appropriate, areas containing nationally/regionally-important concentrations of an IUCN Red-listed EN or CR species.
Criterion 2: Habitat of significant importance to endemic and/or restricted-range species;	(a) Areas that regularly hold ≥10% of the global population size AND ≥10 reproductive units of a species.
Criterion 3: Habitat supporting globally significant concentrations of migratory species and/or congregatory species;	(a) Areas known to sustain, on a cyclical or otherwise regular basis, ≥ 1 percent of the global population of a migratory or congregatory species at any point of the species' lifecycle. (b) Areas that predictably support ≥10 percent of the global population of a species during periods of environmental stress.
Criterion 4: Highly threatened and/or unique ecosystems; and/or	(a) Areas representing ≥ 5% of the global extent of an ecosystem type meeting the criteria for IUCN status of CR or EN. (b) Other areas, not yet assessed by IUCN, but determined to be of high priority for conservation by regional or national systematic conservation planning.
Criterion 5: Areas associated with key evolutionary processes	**No set criteria**

6.12.6.2 Critical habitat evaluation in the UCPS terrestrial system

The species screening process initially identified the species so far recorded in the UCPS area (near the roads, dams and reservoirs) as well as Transmission Line route, which are categorized on the IUCN Red List as Critically Endangered, Endangered or Vulnerable, endemic to Java or otherwise range-restricted, or likely to aggregate in the UCPS area during migration. Each of the species resulting from this initial screening was subsequently tested for the thresholds in the table above to determine whether or not they could trigger the criteria for Critical Habitat (Table 30).

[7] This refers to the criteria for identifying Key Biodiversity Areas (KBA Standards and Appeals Committee 2019)

Table 30. Species that trigger Critical Habitat in UCPS

Common Name (Indonesian / English)	Scientific Name	IUCN Listing or migratory status	Species information	**Critical Habitat (CH) rationale**
Sero ambrang/ Oriental Small-clawed Otter	*Aonyx cinereus* (Illiger, 1815)	VU	Small-clawed otters are ecologically versatile species, often persecuted because of their impact on fish farms. They persist in a range of human-dominated habitats as well as forests (Meijaard 2014).	The species has a large range across South-East and South Asia and the Cisokan population does not support a globally-important concentration of an IUCN Red-listed VU species. CH not triggered.
Trenggiling / Pangolin	*Manis javanica* (Desmarest, 1822)	CR	This once common species of forests and human-dominated landscape has declined sharply because of unsustainable harvest for medicine and food (Challender et al. 2019).	The species has a large range across South-East and South Asia and the CIsokan population is unlikely to contain > 0.5% of the global population. CH not triggered.
Surili/ Grizzled Leaf Monkey	*Presbytis comata* (Desmarest, 1822)	EN	This is an endemic species of West and Central Java of which < 2,500 are thought to remain. The species depends on forests (Nijman and Setiawan 2020).	The species was found in most of the BIAs. No formal population estimates exist, but Cisokan population likely exceeds 0.5% of global population and > 5 reproductive units. **CH triggered.**
Lutung budeng/ West Javan Ebony Langur	*Trachypithecus auratus* (É. Geoffroy Saint-Hilaire, 1812)	VU	This species was recently split into a West Javan and East Javan species, with the species boundary approximately in the Cisokan area. It is unclear which species occurs in the project area. Both species are VU.	There are no reliable population estimates for either of the *Trachypithecus* species on Java, but it is not likely that the Cisokan population supports a globally-important concentration. CH not triggered.
Owa Jawa/ Javan Gibbon	*Hylobates moloch* (Audebert, 1798)	EN	Javan Gibbon is a forest-dependent species unlikely to come to the ground and therefore dependent on connected forest areas. Nevertheless, the species occurs in a surprisingly large number of BIAs and forest corridors in Cisokan.	There are no reliable population estimates but the total population is likely only a few thousand (Nijman 2020). If the Cisokan area has some 10-20 gibbons it could possibly exceed 0.5% of the global population and 5 reproductive units. **CH possibly triggered.**
Kukang/ Slow Loris	*Nycticebus javanicus* (Boddaert, 1785)	CR	This species does well in anthropogenic areas that seem to mimic a secondary tree fall zone, especially with pioneering plants, including bamboo (their most important sleep site), if it is not hunted or collected by communities. Cisokan seems to have an important population with suitable ecological conditions.	Population probably > 0.5% of global population, although no reliable population estimates exist for Java (Prof. Anna Nekaris pers. comm.). Species was found over the years in 14 grid cells, likely representing > 5 reproductive units. **CH triggered**.
Macan tutul jawa/ Javan Leopard	Panthera pardus melas (Cuvier, 1809)	Not eval.	Leopards require shelter and prey but are generally resilient in human-dominated landscapes. The Javan leopard, a highly distinct subspecies (Meijaard 2004) occurs in an area of ca. 1,159,864 ha (Wibisono et al. 2018)	The Javan subspecies is currently listed as Not Evaluated and the species does not trigger the other Critical Habitat criteria. The taxon used to be listed as Critically Endangered by IUCN, however, and there is no clear evidence that the conservation has improved. The UCPS population probably exceeds 0.5% of the global population, and records indicate that there could be

Common Name (Indonesian / English)	Scientific Name	IUCN Listing or migratory status	Species information	**Critical Habitat (CH) rationale**
				>5 individuals. **CH possibly triggered.**
Javan Hawk Eagle	Nisaetus bartelsi	EN	The status of this species in UCPS is unclear. There is one apparent record in Gowek from 2017 but this is not included in the baseline report (2020). This Javan endemic could well occur in the area, as it depends on forested hilly areas.	This species requires confirmation but if present in UCPS would likely exceed more than 0.5% of the global population and trigger Critical Habitat. **CH possibly triggered**.
Sikepmadu Asia / Crested Honey Buzzard	*Pernis ptilorhynchus* (Temminck, 1821)	M	This bird of prey has a resident population as well as a migratory one. Global populations are estimated at 100,000 – 1,000,000 (BirdLife International 2016).	The northern form of the species migrates south, among others through Java. No population estimates are available but the species has only sporadically been recorded in Cisokan and is unlikely to harbour > 1% of the global population. CH not triggered.
Anis Kembang / Chestnut-capped Thrush	*Zoothera interpres* (Temminck, 1828)	EN	This is a forest-bird that does not well in disturbed forest areas and is heavily poached as a popular cage bird (BirdLife International 2020).	The species is recorded in Cisokan but likely very rare and unlike to exceed 0.5% of the global population as it also occurs on Borneo, Peninsular Malaysia and the Lesser Sundas. CH not triggered.
King Cobra	*Ophiophagus hannah*	VU	The Kind Cobra occurs across large parts of SE Asia, but is considered very rare in Indonesia because of deforestation and harvesting of individuals for skin, food, pets, and especially traditional Chinese medicine (Stuart et al. 20112)	There are no reliable population estimates for this cobra on Java, but it is not likely that the Cisokan population supports a globally-important concentration. CH not triggered.
Rosewood	*Pterocarpus indicus*	EN	Rosewood is a highly sought-after timber, overharvested in many parts of its SE Asian range locally resulting in extinction. The IUCN consider it native to Java (Barstow 2018), but it may have been planted in Cisokan.	Recorded in three locations in Cisokan, but the population is not likely to exceed 0.5% of the global population because of its wide distribution across many parts of mainland and island SE Asia. CH not triggered.
Merkus's Pine	***Pinus merkusi***	**VU**	**This pine is endemic to the Philippines and Indonesia and naturally only occurs in the latter country in northern Sumatra. It's been extensively planted throughout Indonesia, and the Cisokan stands should therefore be considered non-native**	**CH not triggered.**

While parts of the upper river areas are in a relative natural condition, the UCPS aquatic system should be considered as modified because of the significant proportion of species of non-native origin (ca. 20%), with human activity having substantially modified the area's primary ecological functions through damming of the Cirata River downstream, deforestation and agricultural land use and altering species composition through unsustainable fishing.

CHAPTER 7. SOCIO-ECONOMIC BASELINE CONDITION

7.1 Introduction

Social and economic baseline data collection is based on a review of previous study documents. In addition, other interview activities were conducted to update the conditions up to 2019 and 2020 (Table 31).

Table 31. 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 project affected population
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.
2006	A structured (questionnaire) interview conducted with the head of the family. Intensive interviews with representatives from 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	Field observations, group discussions, and in-depth interviews with respondents. Respondents were selected based on the capacity required either in position or social status. The questionnaire is usually conducted with closed questions (Social mapping Document, 2019).	Respondents were determined using non-probability sampling techniques or recommendations from the Upper Cisokan hydropower project management. The technical determination of informants was carried out using purposive and snowball methods. The selected sample was 250 respondents from West Bandung Regency and 142 respondents from Cianjur Regency.

Year	Collecting data and analysis method for social impact	Sample
	Interview with the community/respondents around the UCPS hydropower plant using structured interviews (in the form of a list of questions), in-depth interviews with community leaders/key informants, and percentage methods and through descriptive analysis (RKL & RPL, 2019).	The sample population was selected from 981 families of affected residents (WTP) using the Slovin formula with a total percent leeway of 13% so that 56 respondents were obtained from 11 villages. - 11 village official respondents - 3 community leader respondents - 32 community respondents
	Interviews with communities /respondents around the Transmission line area using structured interviews (in the form of a list of questions), in-depth interviews with community leaders/key informants, and percentage methods as well as through descriptive analysis (RKL & RPL SUTET 500KV, 2019).	Population. The sample was selected from 81 households from the affected residents (WTP) on the 500 kV UCPS Hydropower plant transmission line activity. By using the Slovin formula, the amount of percent slack is 10% in order to get 44 respondents from 11 villages - 2 respondents from district officials - 11 village officials respondents - 10 community leader respondents - 22 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.
	Interviews with communities / respondents around the UCPS Hydropower Plant, Transmission Line, Downstream and Resettlement using structured interviews	The selected random sample population was 58 respondents consisting of - 18 Respondents around the Transmission Line - 36 Downstream area respondents - 4 Resettlement area respondents

Detailed data and information on social and economic conditions can be seen in the document "Social and Economic Baseline Report for UCPS 1040 MW Hydroelectric Power Plant".

7.2 Location of Settlement and Housing

Locations of Community Settlements affected by the project, both directly and indirectly, cover 7 Districts, with 2 Districts in West Bandung District, namely Rongga and Cipongkor Sub-districts, and 5 sub-districts in Cianjur District, namely Cibeber, Campaka, Bojongpicung, Haurwangi and Sukaluyu Sub-districts. There was a change in the village area of the Haurwangi, Ramasari and Sukatani Villages. At the beginning of the project the village was part of the Bojongpicung Sub-district but, after the division and restructuration, it was included in the Haurwangi Sub-district.

There Sukaresmi, Bojongsalam, Karangnunggal and Cicadas villages were affected directly by the project's land acquisition. LARAP implementation review report confirmed that 711 of a total of 765 households (93%) have been relocated and 54 households are yet to be relocated. At the moment, the new PAPs' destinations of settlement locations include:

1. Households affected by inundation (upper reservoir)

a. Jegud/Tapos Sand Sub-village, Sukaresmi Village, Rongga Sub-district, West Bandung District.
b. Cidongke Sub-village, Bojong Village, Rongga Sub-district, West Bandung District.
c. Munjul Sub-village, Bojong Village, Rongga Sub-district, West Bandung District.
d. Santik Sub-village, Bojong Village, Rongga Sub-district, West Bandung District.
e. Cihaneut Sub-village, Bojong Village, Rongga Sub-district, West Bandung District.

2. Households affected by inundation (lower reservoir)
   a. Cangkuang Sub-village, Bojongsalam Village, Rongga Sub-district, West Bandung District.
   b. Jolok Sub-village, Cicadas Village, Rongga Sub-district, West Bandung District.
   c. Gunung Batu Sub-village, Desa Cicadas, Rongga Sub-district, West Bandung District.

3. Households affected by inundation in switchyard
   a. Laja Sand Sub-village, Sukaresmi Village, Rongga Sub-district, West Bandung District.
   b. Babakan Sub-village, Bandung, Sukaresmi Village, Rongga Sub-district, West Bandung District

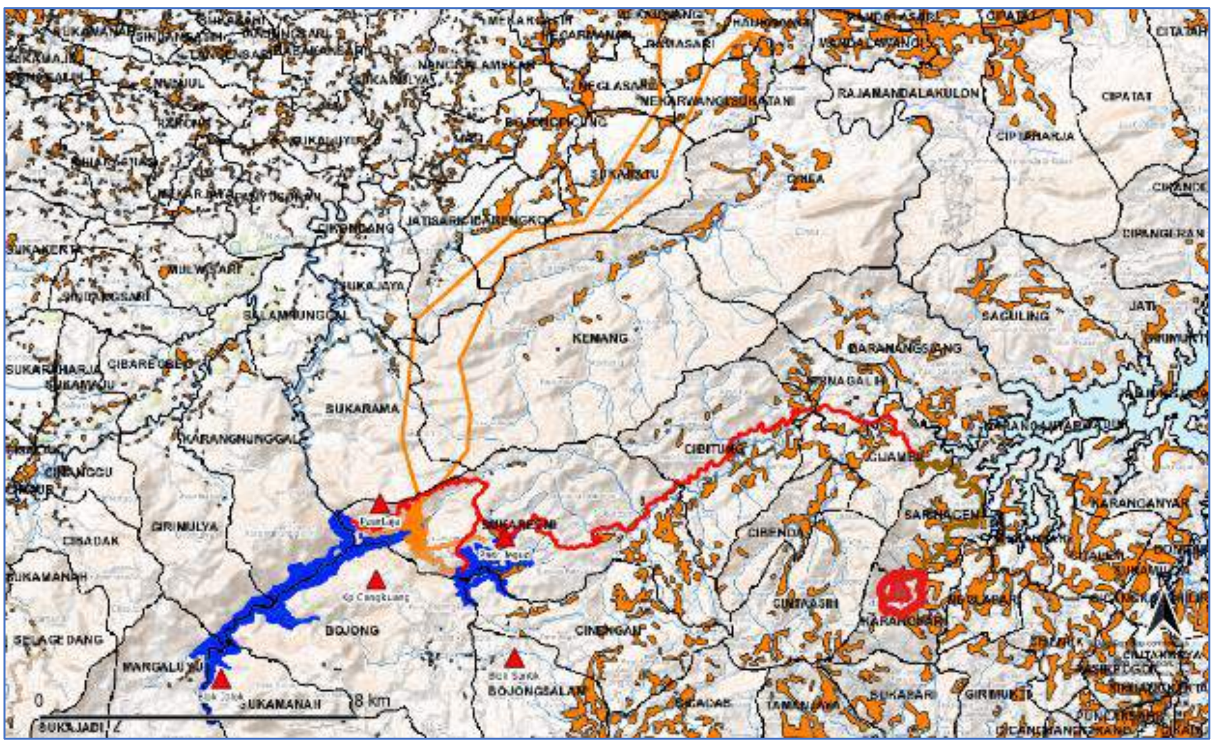

Figure 90. Settlement and Housing Around UCPS Area

7.3 Demography

Based on 2019 data, the administrative area covers villages of varying sizes, from 2.65 km² (Ramasari) to 29.84 km² (Bojongsalam), with populations of each village ranging from 4,362 (Girimulya) to 9,626 (Jatisari) (Table 32). The difference in the area of village administration and population indicates that

the density (people/km²) also varies in each village throughout the project area ranging from 242 people/km² (Kemang) to 2.806 people/km² (Haurwangi).

Table 32. Population Distribution in UCPS Area

No	Location	Area	Demography			Density (Per/km2)	Gender Ratio
		Km²	Population (people)				
			Male	Female	Total		
		WEST BANDUNG DISTRICT					
I	**Cipongkor Sub-district**						
1	Karangsari Village	6.02	2,836	2,774	5,670	932	102.24
2	Sirnagalih Village	3.94	3,041	2,821	5,925	1,488	107.80
3	Cijambu Village	4.90	3,162	2,974	6,202	1,252	106.32
4	Sarinagen Village	7.27	3,868	3,914	7,865	1,070	98.82
II	**Rongga Sub-district**						
5	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	**Cibeber Sub-district**						
9	Desa Girimulya	6.06	2,205	2,156	4,362	719	102.26
10	Desa Karang	15.66	2,828	2,706	5,534	353	104.53
11	Desa Salamnunggal	9,43	2,845	2872	5,717	769	99.05
IV	**Campaka Sub-district**						
12	Desa Margaluyu	8.19	2,745	2,768	5,513	673	99.17
V	**Bojong Picung Sub-district**						
13	Desa Cibarengkok	3.23	2,963	2,597	5,560	445	114.09
14	Desa Jatisari	8.41	4,982	4,644	9,626	2,088	107.28
15	Desa Kemang	25.18	3,077	3,005	6,082	242	102.40
16	Desa Neglasari	3.76	3,290	3,143	6,433	1,711	104.68
17	Desa Sukaratu	10.25	4,506	4,177	8,683	847	107.88
18	Desa Sukajaya	4.34	2,821	2,538	5,359	1,235	111.15
19	Desa Sukarama	11.86	3,453	3,835	7,288	614.5	90
20	Desa Cikondang	3.08	2,361	2,261	4,622	1,501	104.42
VI	**Haurwangi Sub-district**						
21	Haurwangi village	3.2	4,610	4,424	9,034	2,806	99.32
22	Ramasari village	2.65	3,539	3,274	6,813	2,571	108.9
23	Sukatani village	3.16	3,706	3,509	7,275	2,302	103.84
VI	**Sukaluyu Sub-district**						
24	Panyusuhan village	5.16	3,318	3,149	6,530	1,265	107.37

Gender balance is usually around 5%. In general, each village has a gender ratio between 90 (Sukarama) to 114.09 (Cibarengkok). The village with the highest gender imbalance was Cibarengkok village with a male to female ratio of 114.09%.

The new paved road in 2019 opened community access to various places and productive resources. As the result of better road access, the mobility of the younger working-class group out of the village has increased, particularly into industrial and urban centers. The LARAP implementation review report confirmed that the younger generation of the affected communities have a higher propensity to migrate to urban areas, either for schooling, factory work, working abroad, and trading, than their counterparts.

Female participation in work fields, both agricultural and non-agricultural, is limited (51% in the agricultural sector and only 13% in the non-agricultural sector), although, for those involved in agricultural livelihoods, 35% of the wives are the agricultural landowners. However, since the improvement of road access, the roles of women have increased, particularly in the stalls, trading, and handicraft businesses.

7.4 Community Structure

7.4.1 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. The Muslim religion strongly influences day-to-day activities, and village and religious leaders play an essential role in decision-making, problem-solving and village development. Men are considered the heads of households, the primary wage-earners and decision-makers, whilst women manage household and family matters, as well as undertaking planting and harvesting activities.

Education levels are low in all regions, and almost all individuals have only received primary school education. The midterm report of LARAP reported around 93% of the peoples affected by land acquisition in various locations are categorized as only elementary school graduates. Most of the people only received primary education in the villages of Girimulya, Karangnunggal, Margaluyu, Haurwangi, and Sukatani. Meanwhile, in the villages of Sukaresmi, Cijambu, Cinengah, Sukarama, Kemang, Cibitung, Karangsari, Cicadas, Bojongsalam, the majority of the people have education up to Junior High School/equivalent. Only a handful of people who have a diploma or Bachelor's degrees, and most of whom are teachers or civil servants.

7.4.2 Family and Community Structure

In general, the kinship pattern is characterized by traditional Sundanese community system, which determines the descent bilateral relations. In areas characterized by dry land and forestry agriculture, bilateral kinship patterns are common and have a strong influence on settlement clusters. In communities with wetland farming, types of bilateral kinship patterns persist but do not have much influence on settlement patterns.

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 areas dominated by dry land and forestry agriculture, leaders are defined through kinship and socio-religious interests and dominate the decision-making process. Disagreements among residents are usually discussed among family members with the head of the family yielding the most significant influence.

With strong ties among these small hamlet groups, the cohesion in the greater community sometimes suffers when disagreements arise. Community organizations, such as youth groups and farmers organizations (that are not necessarily aligned to families or hamlets) often suffer from the tendency of each hamlet to act in unison against other hamlets. As such, despite the designation as one administrative area (ie the village), the residents do not necessarily function as a community. Different patterns of social relations develop in wetland farming communities that are close to the quarry and the existing road. The area is more open and more receptive to changes with a broad settlement pattern. Social stratification arises as a result of differences in education and wealth and control over resources, such as landowners. Although kinship networks still have and influence, differences in power are more defined by wealth and control over resources.

7.4.3 Religion and Culture

Islam is the religion that dominates and reflects everyday life, such as prayer, recitation of the Qur'an, etiquette and social interactions between communities. Social interactions beyond the scope of work, family and friends are also dominated by religious activities. Religious life is well preserved, demonstrated by the 97 Islamic boarding schools in Cipongkor and Rongga District.

Apart from Islam and its classical educational institutions, Sundanese cultural values are still well preserved, from language to mysticism. For the latter, it is still very much present in everyday life, one such example is about the presence of *Malela* waterfall watchman in Cicadas Village, a person known as *Eyang Taji Malela*, and the prohibition to bathe on Monday, especially for individuals who are not married.

Traditional values are still maintained, including various ceremonies that are still being carried out. One interesting tradition ceremony, associated with farming activities, is called the *Mantra Tandur* in Karangnunggal Village, Cibeber District. It is an ancestral tradition, a symbol of farmers maintaining an agrarian culture especially for paddy planting. The *Mantra* is an attempt to request protection for those things outside of human control. This celebration was held at the Cisokan weir at the same time that the weir maintenance activities were carried out.

Another popular form of entertainment is the '*arisan*', which is a money-gathering that is organized on a rotating basis. *Arisan* is also a community forum to discuss and cooperate on local issues, build and maintain community facilities, inform business opportunities and employment, and assist in food shortages or other difficulties.

Myths and folkore concerning animals are also present in the area. The biodiversity surveys included interviews with community members who highlighted the importance of certain species in local folklore. Rahmat (2009) reports that in the Cisokan community there are animal folklore stories about fish that live in the river, which are "parented" by two larger sized fish named *Rawing* and *Tambal*. The two said fish are identified as a species of freshwater carp (*Kancra*, *Tor douronensis*, thought to be synonymous with *T. tambra*). The community believes that if these parent fish are caught or killed that there will no longer be any more fish when they fish in the Cisokan River. Therefore, if a fishing tool or net catches a large Kancra fish, the community will release the fish straight away for fear that the fish they caught is the parent fish (Rahmat 2009).

The myth that circulates in the community indicates that preserving or protecting these fish is an important matter for the community even though fishing is not their main livelihood.. The belief of this species of fish as a sacred fish is widespread among Sundanese people because of its rarity. The species was reported to be present in the Cisokan River by Rahmat (2009), and Sutrisno et al. (2009), but has not been recorded in subsequent surveys.

In Sundanese communities in West Java there is also a clear presence of taboos against disturbing or collecting slow lorises, linked to beliefs about the perceived importance of slow loris as a link to the afterlife (Nijman and Nektaris, 2014). These beliefs were strongest where slow lorises were observed to live alongside humans; where these beliefs had eroded, or were simply not present, there was a greater incentive to exploit these animals.

7.4.4 Social Relation and Gathering

The population is spread across the villages (hamlets) and includes small village families and communities with strong kinship and traditional attitudes and culture. Islam and religious leaders strongly influence their daily activities. The community has a prominent role in decision making, problem-solving and village development. Men are considered the 'head of the household' and are the primary breadwinners and decision-makers. Women manage household and family affairs, as well as carry out planting and harvesting activities. Education levels are low in all regions, with the majority of individuals having only received primary education.

Table 33. Social Institution in Village around UCPS project

No	Social Institution	Current Condition		Total
		Existed/Maintained	Existed/Weaken	
1	Arts and cultural activities	264	15	279
2	Quran recitation activities	278	1	279
3	Sports activities	270	9	279
4	Hunting activities	231	48	279
5	PAP Cooperative	125	154	279
6	Farm Group and Women Farm Group	275	4	279
7	Collective Action	262	17	279
8	Sharing Tradition/Activities	274	5	279

Quran recitation/study group ("*majlis ta'lim*") is the most active social institution in the community, either on a small scale (in prayer rooms), medium scale (mosques), or large scale in Islamic boarding schools ("*pesantren*") (Table 33). The data shows that several social institutions are perceived to have societal benefits. These include Quran recitation group, sports, collective action (collaboration, participation), and the sharing traditions (sharing and social protection). Other social institutions are farming groups.

Various economic restoration programs which have been implemented as part of the Land Acquisition and Resettlement Plan have strengthened the existing social institutions and created new ones such as cooperatives, including those run by women (banana and palm sugar processing), livestock farm groups, fishery farm groups, and handicraft centers. These institutions are considered essential by the Project Affected People (PAPs). Unfortunately, even after a long period of establishment of these institutions, they still have not been able to advance the productive economy of the PAPs.

Other new social institutions are the Forest Farmers Group (KTH) and Forest Village Community Organisation (LMDH) that were developed within the social forestry program. These two social institutions were established within the framework of community forest management (PHBM).

The people, especially the Cianjur regency, consistently adhere to the principles of '*ngaos*' (the tradition of reciting the Koran), '*mamaos*' (cultural arts: refinement of mind and taste) and '*maen po*' (martial arts of Pencak silat). They also uphold the principles of life which are closely related to religious norms, traditions, customs, beliefs, and institutions. This principle has implications for the pattern of their social and institutional relationships.

The social institutions identified in the village generally consist of LKMD, BPD, PKK and '*Karang Taruna*'. These institutions play an important role in regulating society. For example, LKMD functions as executor of government programs such as poverty alleviation programs, poor rice distribution, economic empowerment programs (LPM, PKK). To accommodate women's involvement, there are Family Welfare Education (PKK) activities.

Related to the forest area around UCPS, forest management activities have involved the community through the Collaborative Forest Management (PHBM) program. For a long time, the communities around the forest have been involved in its management through the *Tumpang Sari* program. In the PHBM program, however, local people have the right to manage the forest with a profit-sharing system. This program was more successful than previous initiatives and saw an increased sense of commitment within the community to preserve their forests.

In connection with the PHBM program, and the establishment of LMDH, a number of LMDHs have been established in the villages around the location of the UCPS (data records of Perhutani, Regional Division of West Java and Banten, not published). In West Bandung Regency, these institutions are LMDH Putra Setia (Sukaresmi Village; 279 members), LMDH Giri Karya (Bojong Salam Village; 159 members), LMDH Rinjani (Cinengah Village; 129 members) and LMDH Gentrawana (Cicadas Village; 441 members). In Cianjur Regency, LMDH Karya Mukti (Sukarama Village; 165 members) and LMDH Wana Mekar Harapan (Karang Nunggal Village; 265 members).

7.5 Gender and Gender Based Violence

7.5.1 Local Gender Relations and Socio-Economic Context

The survey findings for the LARAP found that domestic responsibilities in PAP households are mostly handled by women (88.89%). Women are responsible for range of activities including preparing meals, cleaning the house, caring for children or parents, washing clothes, being agricultural laborers, fetching water, shopping for daily necessities, and processing crops. Further activities include household financial management, harvest utilization and management, decisions to participate in "*arisan*" (social gatherings) and cooperatives, and participation in family planning counseling.

In the productive sector outside of the home, business decisions are primarily made by men (92.5%), although women are increasingly active in the agriculture sector and MSMEs. Of the surveyed women, 51% work in agriculture and only 13% in non-agricultural sectors. Men are very visible in project work, especially in the construction of roads and bridges. However, due to the migration of males to urban areas, there is an increasing presence of rural women in business management, particularly in the stalls, trading, and handicraft business. In the study location, there are food processing and fast-food businesses run by women's groups. Village officials, Islamic boarding school caretakers, and property traders are some other professions undertaken by the women in the area. The profession of shop owner is the dominant livelihood for women in the project location. This indicates a shift in the composition of breadwinner within PAP households, a role which was previously dominated by the male household heads (husbands).

Limited non-agricultural livelihood opportunities mean outmigration is common in the project area, especially for women. Several villages in the UCPS project location, namely KBB and Cianjur Regency, are known to have quite high numbers of migrant workers. According to data from 2016, female migrants outnumbered men 1425 to 192, with most traveling to the Middle-East to work as domestic workers.

Land ownership data from the LARAP shows almost 90% (250 out of 279) of the land is owned or controlled by men. This data contrasts with the fact that, of the households that had decided to resettle, a little over half (41 out of 77) made the decision as a family. In only one household was the decision made by the wife, whereas in the remaining 36 households, the decision was made by the husband only. Indeed, the fact is that in various meetings held by project implementing parties, there is no active participation of these women (LARAP 2019).

7.5.2 Local Gender Based Violence Context

West Java Province is one of the provinces in Indonesia that has a fairly high rate of violence against women. The Indonesian Women's National Commission noted that during 2020, 2,738 women in West Java were victims of violence. They become victims of physical, psychological, and sexual violence; economic neglect; online-based sexual violence; and trafficking.

Based on the existing data, both KBB and Cianjur Regency have a relatively high rate of violence. The Integrated Service Center for the Protection of Women and Children Cianjur, West Java, received 20 reports of violence against women and children in 2019. Most of the reports submitted were sexual abuse or violence, with a total of 12. As for cases of sexual abuse and trafficking to date, there have been three cases and two cases of domestic violence. Meanwhile, until July 2020, P2TP2A recorded 24 cases reported. The average age of victims is 5 to 17 years old, with the most types of violence occurring in the form of sexual abuse and child rape.

Similarly, the Cianjur Regency, West Bandung District, it is also facing serious problems related to cases of violence against women and children. West Bandung Regency (KBB) is one of the areas where cases of violence against children are still high. In the first quarter, at least 19 cases were processed legally, with assistance from the West Bandung Regency Government. Data from the West Bandung District Population Control, Family Planning, Women's Empowerment and Child Protection Agency (DPPKBP3A) shows that the number of cases of violence against children in the first quarter of 2019 was higher than 25 cases. The 2019 cases occurred in every sub-district, although predominantly in the southern region. The victims were typically aged 10-17. The type of violence against children that occurs is not only in the physical form, but also in the verbal form which is usually called bullying. This data description is useful for ensuring that case handling has been carried out by local governments and service agencies, which can inform measures for handling GBVs in the UCPS hydropower project area.

Based on secondary data obtained from previous studies and the results of FGDs conducted in September 2020 by the ESIA team, there are several risk factors for GBVs, namely the community situation (educational aspect) and location. Based on previous studies in Cianjur District, most of the community education was only elementary. Meanwhile, the vulnerable locations for GBVs include housing or school locations close to the temporary houses of workers who come from outside the village (foreign workers or local workers); areas without adequate electric lighting.

In many villages around hydropower project, culturally, there are still child marriages of girls who have dropped out of school. Based on data from the Cianjur Religious Court, every year there are dozens of marriage dispensation applications. There were 12 applications for dispensation of marriage in 2016 with a total of eight cases granted. In 2017 there were 26 cases of dispensation with 26 cases granted, while in 2018 the figure again increased to 33 cases with a total of around 30 cases granted. Based on this, the Cianjur District Government issued a Regent Regulation (Perbup) No. 10 of 2020 concerning Prevention of Child Marriage.

7.6 Community Infrastructure

Infrastructure functions to support various community activities, be it socially, economically, educationally or culturally. Infrastructure can be very influential in accelerating social change. The availability of adequate infrastructure is an indicator of a region's success in development.

7.6.1 Water

The primary community water sources are wells and rivers. Shallow wells, dug by hand, are the primary source of drinking water. In some houses or hamlets with streams/small rivers nearby, only 6% of the total population will use groundwater (PLN/Newjec Inc., 2007b). Water quality samples from both wells in 2006 indicated contamination by pathogenic bacteria that can cause abdominal pain. Well water may be contaminated from activities at ground level because it is not protected (not covered and paved).

Based on the results of interviews in 2020, villages in downstream areas use the Cisokan river water during the dry season. The community usually uses this water for household needs such as washing clothes and bathing, just like the people of Ciputat village and Salamnunggal village, who depend heavily on water from the Cisokan river.

The result of Social Mapping in 2019 shows that some villages, such as Cicadas, Sukaresmi, Sirnagalih, Cijambu and Cibarengkok, have easy, but sometimes insufficient access to water. Meanwhile, in Cibitung, Bojongsalam and Sukaratu villages water sources are easy to find, but not sufficient. In Girimulya and Haurwangi villages, water sources for household needs are difficult to find and insufficient. The LARAP report also stated that 4 relocation locations, Cangkuang, Santik, Munjul, and Cidongke haven't received clean water facilities (boreholes sibel) from PT. PLN (Persero).

7.6.2 Electricity

Based on the 2019 UCPS PLN Social and Stakeholder Mapping report supported by survey results from September 2020, the majority of residents in the Upper Cisokan Pumped Storage area already have electricity (PLN, 2019d). Data on PAPs electricity connection in 2016 confirmed that 85% of the PAPs have direct access to electricity grid, 15% got electricity supply by connecting to their neighbor and 1% of PAPs used power generator and/ or household scale windmills to generate electricity. This data can be used to indicate the overall condition of electricity connection around the project location.

7.6.3 Roads and Bridges

Road access has supported the community in economic and social activities around the project, in the downstream area, based on interviews with community stakeholders in January 2020. The access roads from Baranangsiang village to Sirnagalih (4.8 km) and Cibenah to Cinta Asih (7 km) have been developed. Access roads have increased the value of land from Rp 25.000/m^2 to Rp 400.000/m^2, in certain areas.

In general, the communities' economy improved due to easier access to the city of Bandung. The improved transportation networks have helped people to trade crops, make activities more comfortable and faster, create equitable development, open alternative routes, and facilitate roads to tourist attractions.

On the other hand, community connectivity around the dam will affect families who will not be resettled. There may be periods of unrest and disturbance during resettlement where service facilities and religious buildings are lost or moved and employment and business opportunities change. Furthermore, during land clearing and reservoir preparation, the productive environment of the forest or river, or access to a walking or motorbike path, including river crossing, may change or be permanently displaced. The new bridge will connect parts of the village and will be constructed and operational prior to inundation, to prevent the isolation of communities from markets, schools and communities in the west.

Based on Social Mapping 2019, Community of Margaluyu Village will lose access to the road / bridge connecting Girimulya Village, Karangnunggal and surrounding villages, because the area will be inundated by the river / reservoir PLTA Upper Cisokan.

The connectivity bridge from Blok Jolok to Margaluyu Village is made of bamboo and can only be crossed by foot and motorbike. The path to the bridge location is quite steep. Even so, the existence of this bridge is very useful for community connectivity, which mainly uses the bridge to carry crops / livestock and access to land and fishing grounds.

Two bridges will be built across the Cisokan River and the lower reservoir, to replace the four suspension bridges that currently connect the West Bandung Regency to the Cianjur Regency over the Cisokan River. The bridge serves as access from settlements in the resettlement location of Kampung Cangkuang and Blok Jolok towards Cianjur. The proposed length of the bridges is approximately 350 m and 200 m, respectively. The locations of the bridges are illustrated in Figure 90.

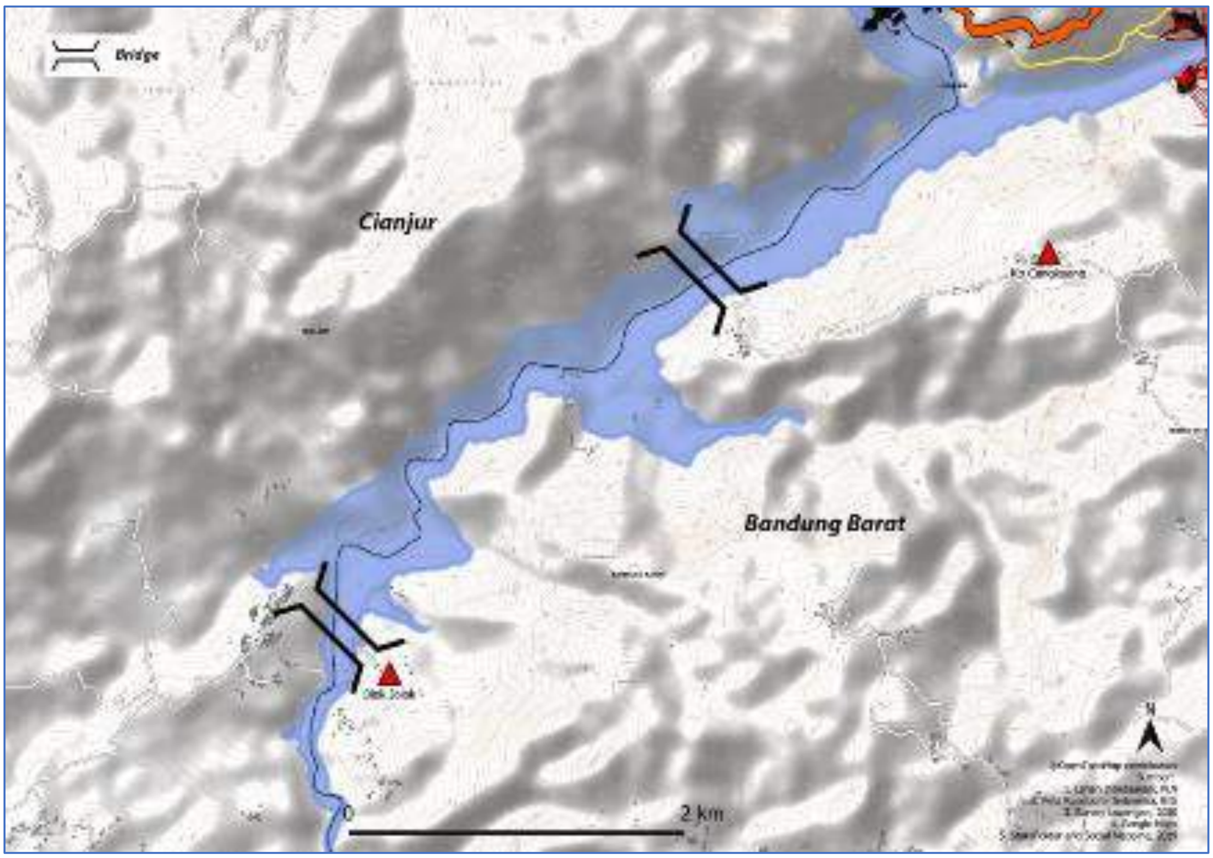

Figure 91. Bridge replacement in the lower reservoir

7.6.4 Sanitation and Waste

Rural communities, in general, rarely have the capacity to maintain adequate sanitation facilities. Bathing, washing, and toilet facilities (MCK) are available but are very simple, both indoors and outdoors. Some rural communities use rivers and ponds for bathing, washing, and as toilets. The monitoring results in ESIA Baseline Report assess the MCK facilities before and after the project operation. Improvement of permanent housing built by post-project and post-compensation of PAP's, especially in lower reservoirs and new roads has led to the increased use of indoor private MCK facilities. The situation is different from the PAP above the reservoir, where dry land is the dominant land type, 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.

7.7 Livelihood

Top three community livelihoods in the project area are farming, trading, and labor. These jobs do not require specialized education. The primary source of income comes from agriculture, which is generally associated with rice fields, mixed gardens, and yards that provide food for the family, as well as additional income from the sale of excess produce in local markets. The majority of family heads in the project area are farmers and farm laborers. Because rain-irrigated rice fields are used, they are only harvested twice a year, so almost all productive workers have additional jobs to support their livelihoods, which are usually around the area. A small number of family heads are retirees, traders, and private employees.

However, since the Cisokan hydropower project's construction, there has been a slight shift in profession for several residents. For those whose agricultural land was acquired, some of them turned to construction work in hydropower projects or manual labor projects. Others remain farmers and looked for new land elsewhere. Apart from the agricultural land, a mountainous area is a forest owned by Perhutani, which is typically farmed by the community on a lease system. Sources of household income, apart from agricultural products, labor and farming, are home industries that engage in palm processing, and banana products. The industry is influenced by the community's ability to build networks and market access.

Various employment opportunities are created and available as access to various productive resources has increased. Various PAPs’ products are expanded to wider markets, including Bandung City and other smaller cities. Movement of the younger working-class group out of the village has increased significantly, particularly into industrial and urban centers. They are not only hired as factory workers but also in trading and businesses. In-migration from urban areas also creates new jobs and businesses (livelihoods) within the villages. Strictly speaking, the PAP group who were identified as unemployed during 2015-2017, now in 2019-2020 were absorbed in the non-agricultural sector that is growing as the result of better road access. Various new jobs emerge along the new roads, such as mechanics (workshops), grocery traders, traveling traders, electronic traders (television, mobile phones, vouchers, internet quotas, and others), and transportation services (motorcycle taxis, rural transportation, freight transport).

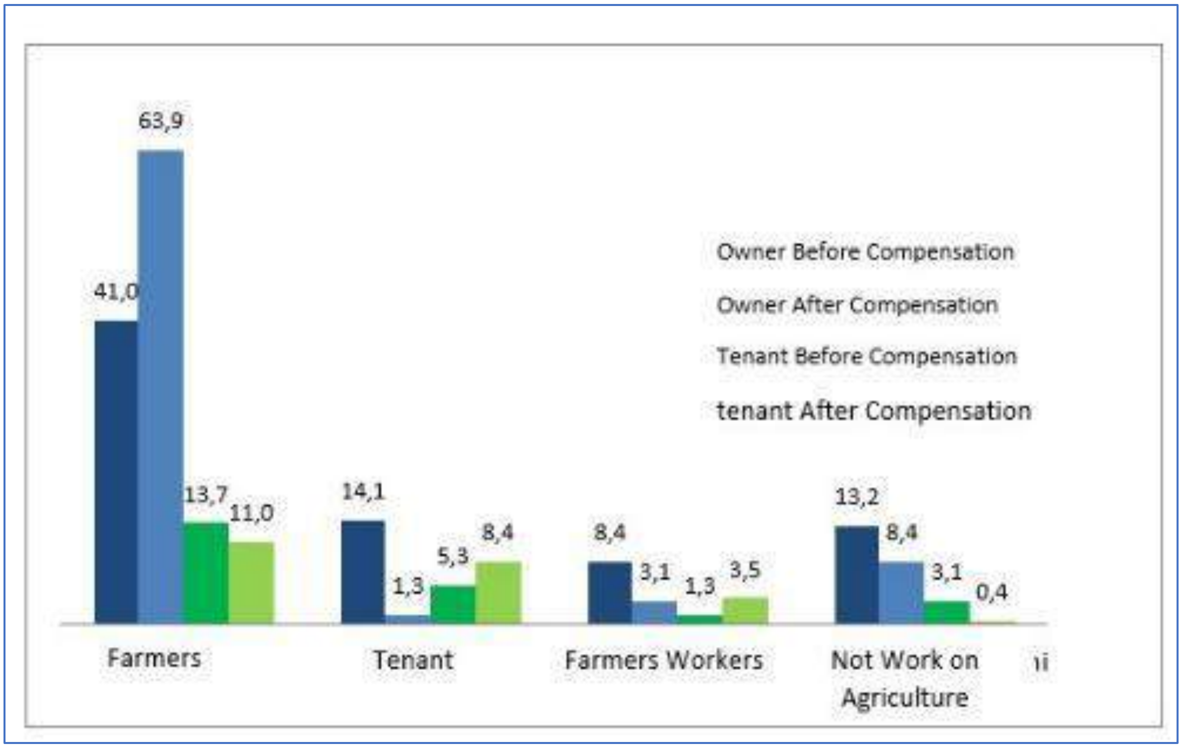

Figure 92. New main agriculture-related occupations of the PAPs based on the land status before and after the compensation payment (%)

Before the project, the majority of PAPs worked as farmers, including in paddy, horticulture, forestry land cultivation, farm labors, and agricultural product traders. Even after the project, the agriculture-related livelihoods are still dominant among PAPs. Figure 92 shows that the number of farmers working on their lands has increased significantly. At the same time, landowners who work on others' land, farm laborers, and those who do not manage their land, has decreased. In general, there is a shift from being cultivators, farm laborers, and off-farm workers to landowner farmers. This happened because with the compensation money allowing landowner PAPs' to focus on working their land employing others to do so. Furthermore, with the reduction of the land area due to the project, there was less farm occupation available.

For those PAPs whose livelihoods were affected by the project, there were training sessions and assistance to prepare them for new livelihoods, such as provisions of:

1. the opportunity to start up food stalls business along the new road;
2. the opportunity to work on PT. Perhutani's land, in particular within the production zone;
3. training on how to be a breeder (sheep, chickens);
4. training on how to be in fishery business;
5. the opportunity to start up paddy cultivation on dry land which access to water sources through water pumps and tractors;
6. training on how to be in craftsman business (wood processing, palm sugar processor, banana processor);
7. training on how to be in trading business (product packaging, online marketing);
8. training on how to be in the brick processor business ("lio");

9. training on how to be a mechanic (motor vehicle workshop training);
10. training on how to be a tailor (convection); and
11. training and assistance on how to be officials for a business group (Community Resilience Institution/LKM, PAP Cooperative).

PLN has also implemented economic/ livelihood restoration programs for the PAPs, including five trainings and three capital assistance packages namely:

1. Animal Husbandry Engineering Training
2. Technical Training and Agricultural Products
3. Micro Business Development Training
4. Business/Marketing Incubation Training
5. Agricultural Intensification Training
6. Animal Capital Package
7. Agricultural Business Capital Package
8. Small Trader Capital Package

7.8 Employment Opportunity

There is a change in employment from the affected area that becomes better. There was a significant increase in land ownership and fewer agricultural workers and a slight change from land workers to off-farm workers. The majority of people affected by the project depend on agriculture and related sectors such as farmers, poultry breeders, sharecroppers, and tractor operators. A small proportion of people work in the trade and handicraft sector (which depend on creativity), and most of them depend heavily on the third person, such as farmers, construction workers, or private workers.

7.9 Income and Poverty Levels

The poverty line in Indonesia is determined based on a minimum calorie intake of 2,100 kcal per capita per month. In March 2019, the Central Statistics Agency described the condition of poverty as an income of less than Rp425,250/capita/month, with the Food Poverty Line's composition at Rp313,232 (73.66 percent) and the Non-Food Poverty Line at Rp112,018, - (26.34 percent).

Poverty in the Cianjur Regency is projected using data from Social Department of West Java Province on Families with Social Welfare Problems (*Penyandang Masalah Kesejahteraan Sosial*-PMKS) at District level in Table 34.

Table 34. Number of families with social welfare problems in Cianjur Regency

Subdistrict	# PMKS	% Against Total Population
Cibeber	5,000	4.06%
Bojongpicung	4,500	5.56%
Campaka	3,200	4.96%
Sukaluyu	4,600	5.50%
Haurwangi	5,100	8.51%

In Bandung Barat Regency, poverty condition is projected using data of Poor Health-Insurance Recipients, published by government of Bandung Barat Regency in 2018. 2770 people (9.43% of total population) in Cipongkor Subdistrict and 576 people (6.52%) in Rongga Subdistrict live in poverty.

Based on the 2019 RKL-RPL, 39% of respondents work as farmers, predominantly cultivating rice and secondary crops. Each profession has a different level of income. 40% of the respondents earned more than Rp. 3,000,000/month. In addition, most of the respondents' income was above the Regional Minimum Wage in Cianjur and West Bandung Regencies in 2019, which was Rp. 2,336,005 to 2,898,744, for professions such as Village Officials, Entrepreneurs, Traders, and Contract Workers. 9% of the respondents earned less than Rp. 1,000,000.

In general, the average household expenditure is between Rp. 1 - 2 million/month. The majority of people also have savings, assets in the form of cash (less than 1 million), and assets (land and buildings). The public financial capital index (scale 0-5, with 5 being the best score) as collected from in-depth interviews and field observations is shown in Figure 93.

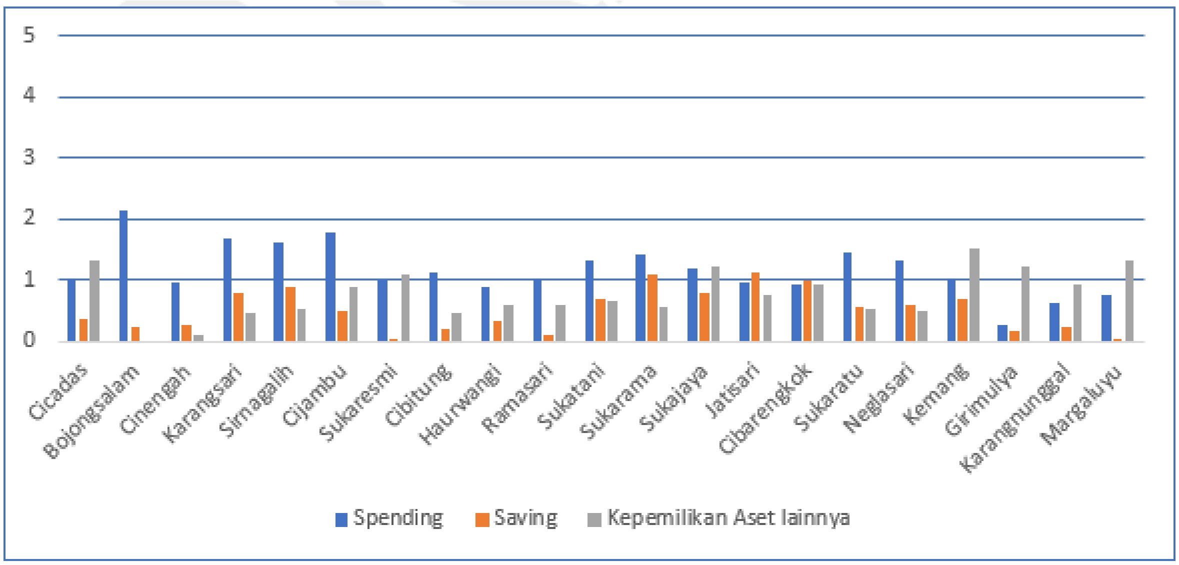

Figure 93. Village Community Financial Capital in the Context of Sustainable Living

There are three villages that have an average household expenditure of less than 1 million/month, while the remaining 18 villages have an average household expenditure of 1-2 million / month. All villages on average have a total savings of less than 1 million/month. The list of villages based on their average household expenditure and savings can be seen in Table 35.

Table 35. The list of villages based on their average household expenditure and savings

	<1 million/month	1-2 million/month
Expenditure	Girimulya, Karangnunggal, Margaluyu	Ramasari, Kemang, Sukaratu, Neglasari, Sukarama, Sukajaya, Jatisari, Cibarengkok, Haurwangi, Sukatani, Karangsari, Sirnagalih,

		Cijambu, Cicadas, Bojongsalam, Cinengah, Sukaresmi, Cibitung
Savings	Girimulya, Karangnunggal, Margaluyu, Ramasari, Kemang, Sukaratu, Neglasari, Sukarama, Sukajaya, Jatisari, Cibarengkok, Haurwangi, Sukatani, Karangsari, Sirnagalih, Cijambu, Cicadas, Bojongsalam, Cinengah, Sukaresmi, Cibitung	

7.10 Land Ownership and Use

For agricultural communities, land is the primary source of income. Ownership or control of agricultural land affects the economic status individuals in the community. Tenure of agricultural land, in the form of rent or production sharing, does not provide the same rights as ownership, so it is very vulnerable for the land to change ownership. Complete information regarding land use is presented in the 2020 Baseline ESIA Report.

The law states, the forest lands cultivated by the community belong to *Perhutani*. However, some local people commented that they have been working on the land since prior to acquisition by *Perhutani*. Some people said that their land was "inherited" from their parents or grandparents. These claims indicated that the forest land that has been cultivated will be owned by the people who cleared the land, which can be passed on to their children. In certain cases, cultivated land can also be transferred to another person (*alih garapan*) with an agreed upon compensation.

The high dependence of the local communities on forest resources (land) has long been accommodated by *Perum Perhutani,* through a collaborative forest management program (*Pengelolaan Hutan Bersama Masyarakat*/PHBM). Community involvement in forest management has been further strengthened with the enactment of a Social Forestry policy, through the Decree of the Minister of Forestry and Environment No. 39/2017 concerning Social Forestry in the *Perum Perhutani* Working Area, which provides forest management rights for up to 35 years to communities.

7.11 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, micro-organisms and their abiotic environments that interact with each other as a single functional unit (MEA, 2005).

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. 2012). Thus, ecosystem services are the benefits or benefits derived by humans from ecosystems both directly and indirectly (Costanza et al. 1997; Costanza et al. 2011; de Groot et al. 2012.

7.11.1 Types of Ecosystem Services

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

1. Provisioning services such as sources of food, water, 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, natural pollination, and 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.

7.11.2 The Use of Natural Resources and Ecosystem Services

Ecosystems have provided natural resources for humans to meet their needs and support livelihoods. These natural resources are called ecosystem services or products. Each community group varies in needs and dependence ecosystem services. 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. 2003). In general, all individuals are very dependent on ecosystem services (Rosa et al. 2003).

Therefore, based on a literature review of existing documents such as: BPS Data (Kecamatan in Number 2019), Monitoring Report on RKL/RPL Implementation, 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.

7.11.2.1 Provisioning Services

Ecosystems in the UCPS region can provide benefits in the form of food derived from biological sources (plants and animals), both processed and unprocessed, which are designated as human consumption. Food supply from ecosystems can be derived from agricultural, plantation, and fishery products. This is reflected by the vast area 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, chilies, cayenne pepper, mushrooms, tomatoes, eggplant, beans, cucumbers, squash, kale, spinach, melons, watermelons and cantaloupe. Fishery products, in the form of freshwater fish, are caught by residents both for consumption and sale.

Cianjur and West Bandung Districts, as administrative areas within the Cisokan watershed area, have the potential for productive agricultural commodity land. A total of 103,493 tonnes/year of agricultural commodities are produced from productive lands in this watershed. The largest contribution comes from a rice production of 92,006 tons per year from the seven sub-districts in the Cisokan watershed area. The area that produces the most rice is the sub-district Rongga, West Bandung District, amounting to 20,201 per year.

Apart from rice, the local community also cultivates cassava, sweet potato, maize and soybeans. Cassava and maize are the commodities that have contributed the highest production figures after rice, worth 5,476 tons and 5,013 tons per year, respectively. The agricultural land in the Cisokan watershed is still able to meet the main food needs of the local community, and can even be used as a profitable industry, to be marketed in other areas.

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), and rainwater 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.

7.11.2.2 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 and carbon sequestration. The function of climate regulation is influenced by both biotic factors, especially vegetation, and the abiotic factors of location and physiographic factors such as altitude and landform. The UCPS area has a high vegetation density and large variations in altitude/elevation. This results in a better climate regulation system that directly regulates carbon dioxide emissions and the greenhouse effect, thereby reducing the impact of global warming. The climate trends in the UCPS region can be seen in section 3.2.1.

The hydrological cycle, is the movement of water in a hydrosphere which includes the process of evaporation, condensation, rain and catchment. Processes of the hydrological cycle that occur in the atmosphere include the formation of clouds and rain, as well as evaporation, transpiration, and evapotranspiration. While the processes of hydrological cycle that occur in the biosphere and lithosphere 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 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 natural disasters. Some functions of preventing natural disasters from fires, erosion, landslides, storms and tsunamis are closely related to the land cover and local landforms. In the UCPS area the closed vegetation coverage protects the area from erosion and landslides.

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 organic matter.

Ecosystem services include local capacity in neutralizing, extracting and absorbing. 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 organic substances that are stable and have no environmental impact. Aerobic microbes in the ecosystem, including bacteria, fungi, protozoa, algae, play a role in the process of neutralizing, breaking down and absorbing waste.

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. Air quality maintenance services in vegetated areas and in high-topographic areas are generally better than non-vegetation areas.

Natural pollination is the process of pollination (the transfer of pollen from the anthers to the pistil of flowers) which occurs in the same flower, between different flowers of the same plant, or between flowers in different plants of the same species. Ecosystems provide natural pollination regulation services, especially through the availability of 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-specific trigger species, controlling pests and diseases.

7.11.2.3 Cultural Services

Ecosystems provide positive benefits for humans, including space to live and prosper. This space is supported by the high suitability of land to support livelihoods socially, economically and culturally. Ecosystem services as a place to live and social space are strongly influenced by physical, geographical and environmental conditions, and greater regional development opportunities. The UCPS region, which has a high slope level, does not have enough space to develop a high-quality residential area. Areas that have mountainous ecoregions and folded hills are also areas that have low and very low carrying capacity. Even though many settlements are in areas of high slope, many are not within the carrying capacity of their environment.

Certain features of ecosystems provide certain values as tourist attractions. Various forms of landscape, the unique flora and fauna, as well as the biodiversity contained in ecosystems are of interest for tourists. Tourism can provide great economic benefits for local communities. The ecosystem and landscape features in the UCPS regions have the potential to promote tourism in the local area. The combination of landscape and culture further strengthens the beauty and aesthetic value that ecosystems have provided.

7.11.2.4 Supporting Services

One type of supporting ecosystem services is the formation of soil layers and maintenance of fertility. Land and its fertility are important determinants for humans when developing agriculture, building settlements, and developing tourist activities. Soil is formed by the 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 observe conditions of high rainfall and sun exposure 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, and energy services to be able to develop due to the availability of fertile soil media for the growth of plants. In supporting the growth of plants, photosynthesis can occur, which absorbs carbon dioxide that would otherwise pollute 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.

Table 36. Agriculture Production in the Cisokan Watershed by Commodities (padi = rice; jagung = maize; kedelai = soy; ubi = sweet potato

KECAMATAN	DESA	KABKOT	Produksi Lahan (ton)					
			Padi	Jagung	Kedelai	Ubi Kayu	Ubi Jalar	Jumlah
RONGGA	CIBEDUG	BANDUNG BARAT	20201	1867	182	4444	175	26869
RONGGA	SUKAMANAH	BANDUNG BARAT						
RONGGA	BOJONG	BANDUNG BARAT						
RONGGA	BOJONGSALAM	BANDUNG BARAT						
RONGGA	CINENGAH	BANDUNG BARAT						
RONGGA	SUKARESMI	BANDUNG BARAT						
RONGGA	CICADAS	BANDUNG BARAT						
SINDANGKERTA	MEKARWANGI	BANDUNG BARAT	17779	1650	325	688	37	20479
SINDANGKERTA	WENINGGALIH	BANDUNG BARAT						
GUNUNGHALU	CILANGARI	BANDUNG BARAT	40274	1496	182	344	96	42392
GUNUNGHALU	SINDANGJAYA	BANDUNG BARAT						
GUNUNGHALU	BUNIJAYA	BANDUNG BARAT						
GUNUNGHALU	SIRNAJAYA	BANDUNG BARAT						
GUNUNGHALU	GUNUNGHALU	BANDUNG BARAT						
GUNUNGHALU	CELAK	BANDUNG BARAT						
SUKANAGARA	SUKAMEKAR	CIANJUR	359.86	0	0	0	0	359.86
CAMPAKA	SUKAJADI	CIANJUR	8586.8	0	0	0	0	8586.8
CAMPAKA	MARGALUYU	CIANJUR						
CAMPAKA	MEKARJAYA	CIANJUR						
CAMPAKA	CIDADAP	CIANJUR						
CAMPAKA	CAMPAKA	CIANJUR						
CAMPAKA MULYA	CAMPAKAWARNA	CIANJUR	4793.8	0	0	0	0	4793.8
CAMPAKA MULYA	CAMPAKAMULYA	CIANJUR						
CAMPAKA MULYA	SUKABUNGAH	CIANJUR						
CAMPAKA MULYA	CIBANGGALA	CIANJUR						
CAMPAKA MULYA	SUKASIRNA	CIANJUR						
CIBEBER	GIRIMULYA	CIANJUR	12.29	0	0	0	0	12.29
CIBEBER	KARANGNUNGGAL	CIANJUR						

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 of photosynthesis, that occurs in the biosphere. Ecosystems naturally provide nutrients needed by plants in the soil. Plants absorb these nutrients which then accumulate 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 ultimately affects the soil fertility and subsequent agricultural production. This nutrient cycle supports agricultural activities because, with a good nutrient cycle, the fertility of agricultural land is well maintained, and ultimately contributes to other ecosystem services such as food, fiber, energy, climate regulation, and maintenance of air quality. The UCPS region, which is a mountainous region, is indicated to have a high carrying capacity for this ecosystem service.

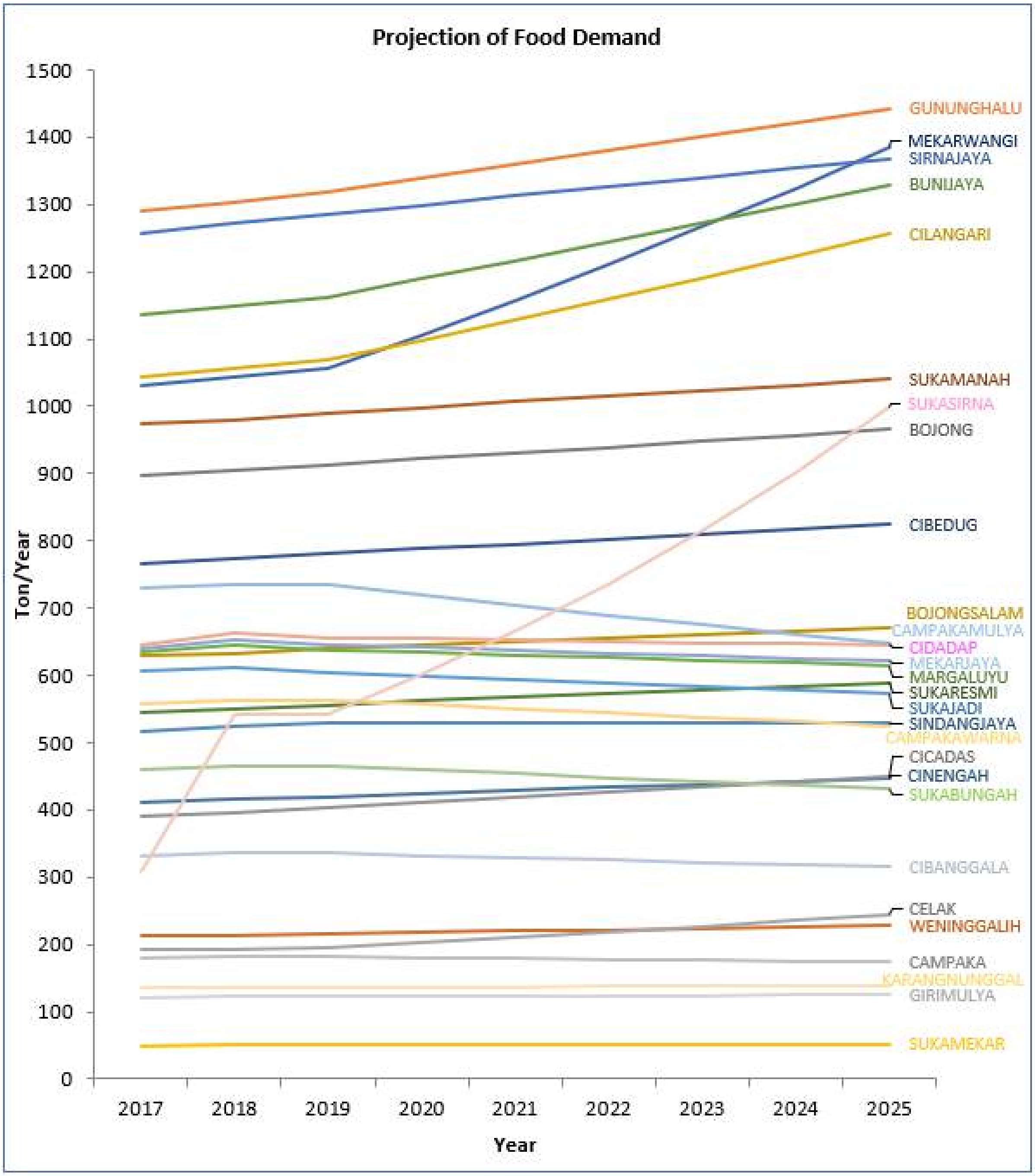

Figure 94. Projection of Food Demand in Village at Cisokan Watershed

Ecosystems in the UCPS region can also provide primary production services in the form of oxygen production and species habitat provision. Ecosystems provide oxygen-producing services while reducing carbon dioxide levels and air pollution. Plants absorb carbon dioxide and produce oxygen (photosynthesis). Oxygen is required for respiration in living species. Oxygen production services vary between locations and are closely related to the presence of vegetation and forests. Forested areas provide a very high carrying capacity and, therefore, observe intensive photosynthesis.

Ecosystems in the UCPS region observe high biodiversity both within species, and between species and ecosystems that constitute a breeding habitat for flora and fauna. The higher the biodiversity, the higher the function of the ecosystem. High-functioning ecosystems provide direct benefits to local communities. In areas that have high primary production services, carrying capacity and the capacity for biodiversity services are also high. A description of UCPS biodiversity values can be seen in Chapter 6.

Based on a literature review of existing documents, such as: data from the Central Bureau of Statistics (District in Figures 2019), Monitoring Reports on the Implementation of RKL/RPL, journals or the results of previous studies on ecosystem services in Cianjur Regency and West Bandung Regency, several ecosystem services were identified in the UCPS project area that can be utilized by PAPs and other residents. The services of note are in the form of provision, regulating, cultural, and supporting services.

The Cianjur and West Bandung Districts, as administrative areas within the Cisokan watershed area, have the potential for productive agricultural commodity land. A total of 103,493 tons/year of agricultural commodities are produced from productive lands in this watershed (Table 36). The largest amount is produced from rice production, 92,006 tons/year from the seven sub-districts in the Cisokan watershed area. It can be seen that the agricultural land in the Cisokan watershed is still able to meet the main food needs of the local community and can even be used as industry to be marketed to other areas.\

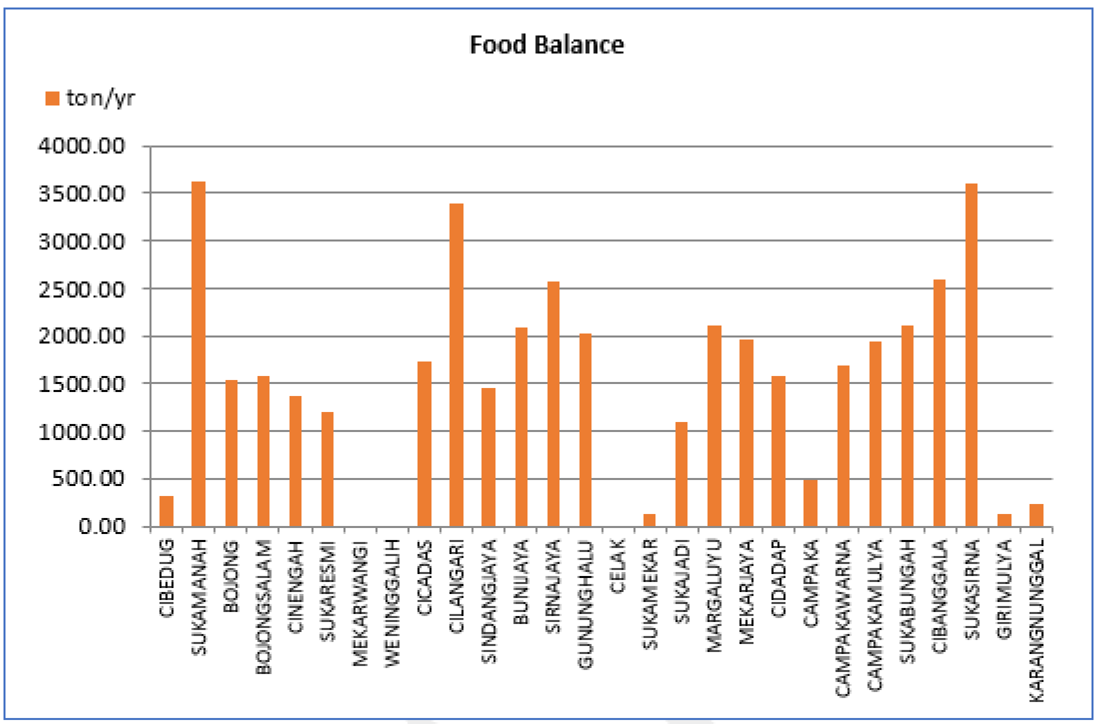

Figure 95. Food Balance in Cisokan Watershed

Food demand projection for 2025 in the Cisokan Watershed was analyzed based on 2017 figures. Most of the villages in Campaka and Campaka Mulya projected a decrease in demand by 2025 due to decrease of population (Figure 94). When compared with the food production by the village itself, Mekarwangi and Weninggalih Village in Sindangkerta Sub-District and Celak Village in Gunung Halu Sub-District have a negative food balance based on the trend. The trends in projected food demand are shown in Figure 95.

7.12 Health Service

Health services exist in the form of health centers, auxiliary health centers (*Pustu*), and hospitals managed by local and private governments. There are also health services in the form of clinics/polyclinics, doctor, and midwife practices, which are managed privately, and *Posyandu* that are managed by the community. There is also a mobile health service to expand health service coverage to residents who find it challenging to treat their issues at the local government clinics (*puskesmas*) because of their remote location.

7.13 Public Opinion

7.13.1 Activity Engagement and Community Feedback

Based on the 2019 RKL-RPL Monitoring Report, which surveyed 100 people (56 people from power plant area and 44 people from transmission line area), all respondents already know about the UCPS hydropower development activities. This cannot be separated from the socialization and development activities that restarted in 2018, following a pause from 2008 to 2016, when PLN have held the public consultation. As for the plans and schedules for ongoing development activities, most people do not know (68%). Some respondents (32%) stated that the primary benefit of construction activities was the improved road access. A further 29% of respondents considered that job opportunities were improved, where the implementing contractor always prioritized the recruitment of local workers. In addition, 23% of respondents stated that they had better public and social facilities, such as roads and bridges, religious facilities, health facilities, sanitary facilities, clean water facilities, electricity networks, and others. Based on field observations, the most positive impact felt by residents was the construction of new roads.

Respondents also knew about the 500 kV UCPS hydropower plant Transmission Line plan from the socialization that has been going on since 2007. Meanwhile, the forms of problems or negative perceptions expressed by residents include the process of land acquisition, employment, compensation for community comfort, health, explosion disturbance, cracks in the house, the absence of electricity, the unsuitable SPPT value, and the remaining land compensation that has not been paid. Based on the results of the interviews, the land acquisition that has not been completed is the community land (*Tanah Kas Desa*) and land in the planned inundation area.

7.13.2 Mechanism and Types of Complaints

In January 2013, PT. PLN established the Complaint Handling Task Force to manage complaints related to implementation of LARAP. The personnel of this Task Force came from non-profit organizations or universities, and/or experts who have commitments to and experience in community development. The Task Force activities included: receiving complaints, field verification, and monitoring the complaint resolution process. To provide convenient access for residents if there were any problems and to accelerate field verification, the Task Force team assigned field workers to be posted at the Cipongkor and Rongga Sub-district offices. The task force is temporary for the context of land acquisition, but it is an embryo for Community Organizations to accommodate community complaints at the local level and then submit them to the Grievance Task Force (GTF) Team, to be forwarded to relevant parties.

The GTF Team was reassigned in June 2015, with a working period until May 2016. This assignment was in line with the commencement of the land acquisition process in the transmission road project area, in August 2014. During this one-year working period (June 2015-May 2016), the Complaints Handling Task Force provided 3 channels for receiving complaints; through the TPA hotline number, direct visits (Basecamp/UPK/PMK), and through village facilitators.

After May 2016, the Complaints Handling Task Force assignment was no longer extended. As a result, from June 2016 to October 2018 (28 months), there were no records of complaints from the public. Recording of complaints reappeared in November 2018. The party in charge was Legal, Communication, and Land Affairs at UPP.

PT.PLN received between 15 to 95 complaints annually from 2013 to 2017. In 2018 there were 35 complaints, followed by 29 complaints in 2019. In 2020, PLN received 41 complaints from the public. More complete types of complaints are presented in the 2020 ESIA Baseline Report document.

Related to the Biodiversity Management Plan, awareness of the appeal not to trap and kill wildlife was integrated into the dissemination of animal conservation and environmental protection. It has been carried out several times in several different locations, including in Cangkuang hamlet. In several houses in Cangkuang hamlet (BIA 14), a sign that reads "Posts for Grievance on Animal and Plant Environmental Problems" has been installed as a follow-up to the conducted dissemination program.

A Grievance Redress Mechanism has been developed as part of the SCMP to ensure that all concerns/ complaints will be followed up and processed in a transparent and timely manner throughout the project cycle.

7.14 Traffic and Road Safety

Traffic conditions can be reported based on the results of monitoring the implementation of RKL-RPL from 2018 to 2019. Traffic Surveys havr been carried out at 2 (two) monitoring points with the following descriptions:

1) Cijenuk – Cipari Direction (Cipari Intersection)

Cijenuk - Cipari Road is an access road for the entire area of Cipongkor District, especially for the villages of Sarinagen and Karangsari. In Cijenuk, there are markets and bus terminals to the city of Bandung. This type of road is a two-lane two-way road without a median (2/2 UD). This road is not as busy as the Saguling (Rajamandala) junction. Residential areas, commercial places in the form of kiosks, schools, the Grand Mosque and Islamic Center, the Office of Religious Affairs, Cooperatives and the Cipongkor District Office are found along the existing road.

Based on the results of the analysis of the Capacity and Characteristics of the Service Level of the Cipari Intersection Road Section from 2018 - 2019, the Cipari - Cijenuk road section has a service level of A. There are no speed limits on this road.

2) Quarry Direction (Sarinagen Intersection)

The road condition at the location of the Gunung Karang mining plan has been paved using asphalt to the boundary of the Mount Karang mining area. The asphalt paving facilitates the movement of andesite transport vehicles from the mine site to the lower and upper dams.

The road from Cipari to the Bojong Loa intersection is a village road and provides access to the entire village area of Sarinagen and Karangsari, Cipongkor District. When the Saguling hydropower project was built, this road functioned as an access road to Gunung Karang (quarry). As a paved road with a width of ± 10 m, this type of road is a two-lane two-way road without a median (2/2 UD). A T-junction comes from the direction of Cipari - Gunung Karang - Cililin. There are several community activities around the old access road between Mount Karang and Cipari, including grocery stalls, food stalls, kiosks, residential areas, Cimega elementary schools, Cipongkor special-needs education school, and the Al-Barqunnajah Foundation School.

Based on the results of the analysis of the Capacity and Characteristics of the Service Level of the Bojong Loa Simpang Road Section from 2018 - 2019, the road to the hydropower plant has a service level of A. There are no speed limits on this road. It should be noted that this road descends towards the Saguling hydropower plant, and there is also a traditional market at the intersection.

Based on reports on the results of field observations and the trend of the results of the 2018 and 2019 UCPS RKL-RPL Monitoring, the road safety aspects have improved. Runoff control in the form of drainage channels along the shoulder of the main road and the mine site of Gunung Karang, have been built from mortar and stone masonry. The drainage channel needs maintenance because there are several locations where the canals are covered with vegetation. Overall, the management of erosion and sedimentation associated with road construction activities has undergone significant changes.

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 in the form of equipment on the road 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 side of the road. However, some road signs/marks have been stolen, 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 re-installed, and monitoring will be carried out so that the incident does not happen again. Noise barriers are not currently installed along existing and new roads.

Street lighting has been installed on the left/right side of the existing road, which is used to illuminate the road and the environment around the road. The lighting on the new access road has not been implemented.

7.15 Natural Disaster Assessment

7.15.1 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, 2007). 62 earthquakes were recorded in Cianjur Regency between 1992 and 1993. Based on a seismic hazard study in 2017, Peak Ground Acceleration (PGA) in UCPS area is 0.5 to 0.6g (PLN Enjiniring/Nippon Koei/Newjec Inc./Indokoei International/Wiratman, 2019c).

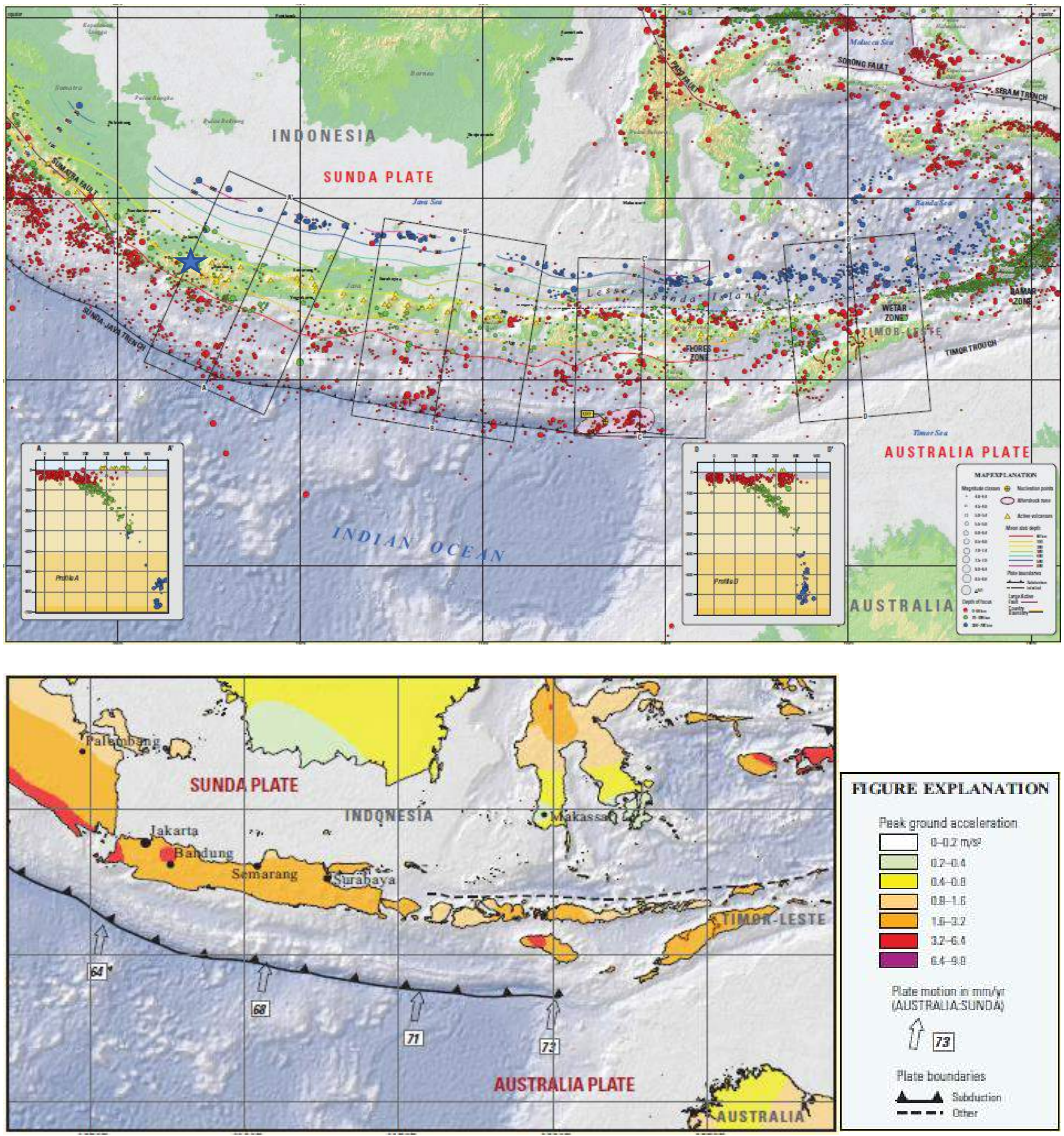

Figure 96. Java Seismic Seismicity 1900-2012 (Jones et al. 2014). Blue star in top map indicates project location.

7.15.2 Slope Stability

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

There were nine landslides in the period between 1990 and 1994, which affected the livelihoods of nearly 1000 people in Cianjur Regency (PLN, 1998). In 2009, an earthquake measuring 7.3 on the Richter scale triggered a landslide in Cianjur Regency and killed several people.

Slope stability within the project area was studied in detail in 2007 to assess the level of landslide risk in the reservoir area. Several areas with the potential for landslides have been identified in the upper reservoir.

7.15.3 Landslide Characteristics and Management of Slope

The landslide observed on the main road of the Upper and Lower Cisokan Hydroelectric Power has different characteristics, both the type and causes. In general, these locations are on slopes with an angle that has more than 45 degrees. Aside from the slope, there are several other causes of landslides, namely weathering, erosion, weak field position, and the presence of clay shales. Landslides generally occur at the boundary between bedrock and soil. Landslides occur in many slopes. The soil on steep slopes of 40°-60° soil is easily eroded, leading to landslides. In hard sandstone lithology or 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. The cliff is strengthened with terracing, gabion ornaments or other reinforcement models.

Work on the management of slope and landslide areas was carried out in 2018, after the road construction in 2013 - 2016. Road repairs and coatings also accompanied this work. Work on handling the slope and landslide areas has been carried out at more than 60 points, and the maintenance is ongoing. Some of the work at this stage includes work on gabion walls, soil retaining wall, river stone retaining wall, shotcrete work and rock bolt/soil nailing. From several landslide locations on the road that have been and are being repaired, 2 (two) locations were identified as being of high potential risk are named ST.10 + 500 and ST.13 + 100. At present, handling and monitoring of landslide points has been carried out on access road. Management of slopes that have the potential for landslides due to cutting road cliffs has mainly been strengthened. The techniques used are 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 Akar Wangi/*Vetiveria zizanoides* on the new road's cliff.

7.15.4 Rock Porosity

The level of rock porosity is important to predict the potential for water loss from reservoirs into groundwater and the interaction between surface water and groundwater. The level of water breakdown in the dam's foundation rock has been measured using a water pressure test in the test hole. The porosity level of bedrock in the upper and lower dam was generally low to very low, except for one sample in the upper dam. Most of the borehole test results show a higher level of porosity in the weathered rock near the surface at each of the dam sites.

Flood risk is discussed in the hydrology section.

7.16 Cultural Heritage

The customs and traditions of the community in and around the project area are representative of the customs and traditions of the Sundanese people. Sudanese artistic and cultural traditions are still preserved and practiced throughout the project area and the wider West Bandung Regency and Cianjur Regency. The Sundanese cultural traditions are present both as tangible and intangible artefacts, as mentioned in Section 7.4.3. Many traditions and ceremonies are still practiced and include *Saweran, Qasidah, Selametan, Sunatan*/Circumcision, *Sawer Panganten, Lamaran, Tujuh Bulan, Puput Puser, Gotong Royong Lobaan (Gorol*), and *Ziarah* (PLN, 2019d).

A comprehensive cultural heritage survey (Physical Cultural Resources Survey), which included religious buildings and private graves, was conducted in 2009. The survey was carried out in consultation with the community and included the identification of the location, grid reference location using GPS, and photographic recording. The report, which is provided as standalone report (Appendix H), contains comprehensive descriptions, maps and photos for each location.

None of the sites which are registered with local and national authorities have legal protection. Locations that have particular importance, because they have religious or other significance, are considered sacred graves, by the surrounding community and pilgrims, namely *Batu Bedil* and *Maqom Mbah Tubuy* (highly regarded men's graves). However, there are also many private graves and religious structures within the project area which should also be respected and protected during reservoir construction and preparation.

CHAPTER 8. PUBLIC CONSULTATION AND FEEDBACK

This chapter summarizes the bullet points on the public/stakeholder consultation activities undertaken as part of the environmental and social impact assessment for the construction of the Upper Cisokan Pump Hydropower Plant and the 500kV transmission line. The public consultation was held on 30 September 2020, using the online Zoom meeting platform and in-person in 5 locations, namely the Bappeda Office of West Bandung Regency, Rongga District, Cipongkor District, Haurwangi District, and Bojongpicung District. Material presented at public consultation activities includes:

1. Inventory result data from environmental and social monitoring reports
2. Assessment and management of environmental and social risks and impacts
3. Acquisition of people's land used in the project (from now on referred to as aspects of LARAP)
4. Boundary Determination of project-affected people or PAPs
5. Risk determination of the UCPS project to the social and economic life of the people in the affected area
6. Assessment of the project's impact on cultural heritage
7. Assessment of stakeholder engagement
8. Legislative aspects include the laws and regulations that have been established by the government and become the legal basis for the preparation of the ESIA for the Development of the Upper Cisokan Pumped Storage (UCPS) Hydropower Plant.

Through this public consultation, stakeholder and community suggestions are accommodated for consideration in project development implementation. Several participants raised concerns, questions, comments and suggestions about aspects related to the project in the public consultation held at 2020. A summary of questions, input, and suggestions submitted by the community during public consultation activities can be seen in Table 37.

This is not the first public consultation that has been held by PLN. There were several public consultations held since 2008 as described in Table 38.

Table 37. Summary of questions, input and suggestions submitted by the community

No	Public Figure/Related Institutions	Points Conveyed
1.	Ministry of Religion, West Bandung Regency	1. There are about 14 locations (5 villages) related to the donated land, including graves, madrasas, and mosques. The building has been demolished but has not been rebuilt. It is hoped that the processes related to the facilities and infrastructure for worship places can be completed soon. 2. PLN has built the Religious affairs office on the affected waqf land, but an official written Handover has not been conducted.
2.	Community and Village Empowerment Office, West Bandung Regency	1. There are community lands in 5 villages which are the affected areas. There are different perceptions regarding the legal aspects related to the value of the community land for replacement.
3.	Cijambu Village Head	1. Replacement of village assets and village treasury lands, especially in locations adjacent to the project site in the Cijambu village area, can continue 2. Social impact of workers entering the project site 3. Expectations for community involvement in the Upper Cisokan project
4.	Cianjur Department of Agriculture	1. There is synergy with irrigated areas, especially Cihea and Cikondang, considering that the Cianjur area is a food barn for rice producers that utilizes irrigation channels. 2. Expectations regarding synergy in community empowerment

5.	Sukaresmi Village Head	1. Hope for the continuity of the road access construction process that has just been built 900m 2. Expectations for completing the replacement of the remaining land and community lands in the Sukaresmi village area. 3. Expectations for the realization of cooperatives 4. Expectations for community involvement in the Upper Cisokan project
6.	Sukaresmi Villagers	1. Post access road work has an impact on building construction damage and private property 2. Expectations for proper guidance and management related to the PAP cooperative
7.	Kepala Desa Cicadas Village Head	1. Expectations for the completion of the replacement of the waqf land and village treasury lands. 2. Expectations for proper guidance and management related to cooperatives
8.	Rongga District	1. Hope for COMDEV completion priority 2. Expectations for clarity of targets regarding activities related to the development of Upper Cisokan

In general, the community already knows about the planned project activities. During public consultation activities, the community generally supports the project and hopes that they will remain informed, involved, and receive appropriate compensation along with certainty for all the losses they have suffered.

The project has prepared a comprehensive Stakeholder Engagement Plan and Grievance Redress Mechanism as part of the SCMP to build to ensure transparent, open consultations and dialogue throughout the project cycle by:

- Ensuring that all stakeholders are fully informed and relevant project impacts disclosed;
- Ensuring participatory local community feedback and monitoring on the effectiveness of environmental and social mitigation measures;
- Maintaining broad support (stakeholder buy-in) for the project at the local level;
- Identifying opportunities for community sustainable programs.

Table 38. Summary of public consultations held by PLN since 2008

No	Theme	When	Where	Who & how many people participated	Key issues raised during the consultation	How these issues were addressed in the revised documents
1	Resettlement plan for existing road	23 October 2008	Sub-District office of Cipongkor	47 participants: • Sub-District Officials • Board of Sub-district leaders • Village Officials • Community Leader and representative of the PAPs	1. Compensation for their buildings/assets along the RoW in the existing road. 2. How local people can have opportunity to work in project construction.	1. The project will provide compensation for their assets (after loan agreement) 2. Accommodated in the EMP: The construction labour will be recruited from local villages to construct and maintain the sections of road near their respective villages in accordance with the construction labour capability.
2	Resettlement plan for existing road	23 October 2008	Village office of Sarinagen.	77 participants: • PLN Generation and Transmission of West Java, • LPPM UNPAD • District Officials • Sub-District officials • Village officials • Informal Leaders, and • Representative of PAPs	Compensation for their building's asset along the RoW of the existing road	The project will provide compensation for their asset (after signing of loan agreement)
3	Resettlement plan for new road	25 October 2008.	Village office of Cijambu, Cibitung, Sukaresmi	42 participants: • PLN Generation and Transmission of West Java, • LPPM UNPAD • Sub-District Officials • Sub-District Leaders • Village Officials • Informal Leader, and • Representative of the community who area affected by the Project.	1. Transparency on payment 2. Administration cost for land certificate of the remaining land. 3. Compensation for private grave/cemetery.	1. Direct payment through bank account. 2. Administration cost is part of assistance covered by the project. 3. Covered in the EMP that the project will provide compensation to the private graves.
4	Resettlement plan for transmission line and tower	30 August 2009	Subdistrict office of Haurwangi, Cianjur District.	75 participants: •Representative of 11 villages •PLN Generation and Transmission of West Java, •LPPM UNPAD • Sub-District officials • Sub-District Officials • Village Officials • Community Informal Leaders and	1. Transparency on payment. 2. More information on negative impacts on health from transmission lines 3. Incentive for ROW of transmission lines is too small (10% of NJOP).	1. Direct payment through bank account. 2. Covered in the EMP section III Operation Stage about mitigation measure. 3. To be considered in Loan Agreement (10% of market price).

No	Theme	When	Where	Who & how many people participated	Key issues raised during the consultation	How these issues were addressed in the revised documents
				• PAPs of the transmission line project • PAPs of the Tower project • **Representative of women group** • Community leaders	4. Grievance redress handling unit located at the closest to PAP's location.	4. LARAP on Grievance redress handling
5	Resettlement plan for lower dam	8 October 2009	Karangnunggal Village office, Sub District Cibeber, Cianjur	71 participants: • PLN Generation and Transmission of West Java, • LPPM UNPAD • Sub-District officials • Sub-District Officials • Village Officials • Informal Leaders • Representative of PAPs • Representative of tenants in the forestry area • **Representative of women group**	1. Market price requested by PAP for all affected asset and their livelihood. 2. Transparency on payment. 3. Accessibility in the new sites and rehabilitation assistance to restore the livelihood 4. More consultation with the PAP on value and options of compensation. 5. Sharecroppers/tenants will lose income from cultivating forestry land. **6. Women participation on land acquisition process.**	1. Licensed appraiser will asses affected assets assessed by refers to the replacement cost as described in the independent appraisal TOR. 2. Direct payment through bank account. 3. New location will be as close as possible from their previous village. Public utilities and infrastructure will be provided in the new location. Rehabilitation assistance will be considered as PAPs need 4. PLN will work closely with the LAC during land acquisition process 5. Rehabilitation assistance for such PAPs. **6. Covered in Gender mainstream strategy.**
6	Resettlement plan for lower dam	9 October 2009	sub district Campaka office, District Cianjur,	45 participants: • PLN Generation and Transmission of West Java, • LPPM UNPAD • Sub-District officials • Sub-District officials • Village Officials • Community Informal Leaders and • Representative of PAPs • Representative of tenants in the forestry area	1. Market price requested by PAP for all affected asset and their livelihood. 2. How the physically displaced people will move to new site 3. Women's question: public school for their children 4. More information on facilities and utilities in new sites.	1. TOR of valuation for affected assets by licensed appraiser refers to cost approach (without depreciation) and market price. 2. PLN will provide resettlement assistance 3. PLN will rebuild the affected school and/or may build new school in the new site. 4. Consultation and discussion as described in ch. 5 of LARAP.

No	Theme	When	Where	Who & how many people participated	Key issues raised during the consultation	How these issues were addressed in the revised documents
				• **Representative of women group**		
7	Project development plan	11 Nov 2009	PLN Project Prokitring West Java office, Bandung	Relevant institutions from: West Java Province , West Bandung District and Cianjur District	How to synergize objectives of the project with the regional government programs.	Accommodated in LARAP documents.
8	Socialization of UCPS Project and implementation of CSR Program (donation **for schools and mosques** renovation)	11 February 2010	Pondok Pesantren Pusaka Baru at Sirnagalih village, Cipongkor sub-district, West Bandung district.	- Mayor of West Bandung district - Head of Sirnagalih village - Head of Cipongkor sub-district - Principals of Sirnagalih and Cipari elementary school - Community leaders		
9	Socialization of UCPS Project and implementation of CSR Program (donation **for schools and mosques** renovation)	19 March 2010	Karangnunggal village office, Cianjur District	- Bupati of Cianjur district - Head of Karangnunggal village - Head of Cibeber sub-district - Principals of Cisero and BinaWarga elementary school - Community leaders -		
10	Socialization of UCPS Project	25 May 2010	NGO office, Bandung (Dewan Pemerhati Kehutanan dan Lingkungan Tatar Sunda)	Members of DPKLTS	Land substitution for forest land to be in the Cisokan catchment area	Study on location for land substitution (December 2010 to March 2011)
11	Dissemination of information for Upper Cisokan Project	7 August 2010	West Java Governor Official House	Governor, Director of PLN, Provincial Official Officers from Dinas Kehutanan, Perum Perhutani, BPN	Governor is waiting for BPN' decision regarding with determination of location	Project delayed
12	Upper Cisokan Hydro Power Pumped Storage Development Plan	23-26 September 2010	Jakarta Convention Center on Indonesia Business – BUMN Expo and Conference (IBBEX)	- Public		Advantages of hydro power pumped storage power plant compare to conventional hydro power

No	Theme	When	Where	Who & how many people participated	Key issues raised during the consultation	How these issues were addressed in the revised documents
13	Hydro Power Pumped Storage Technology	21 October 2010	Institute of Technology Surabaya	- Prof. Roman Klasinc from Austria - ITS Students - ITS Lecturers - Department of Public Works of East Java		Project preparation and description
14	Resettlement plan for existing road	24 Oct 2010	Rongga sub-district office, West Bandung District	54 participants: sub-district officials, subdistrict officials, village officials, informal leaders (religious, community, **youth**); representatives of PAPs subdistrict	1. Value of compensation refers to the market price. 2. Relocation site: 1. Move by them-selves. 2. Follow PLN's program. 3. PAPs want to know precise time on construction of the Upper Cisokan Pumped Storage Project because they have uncertainly waited since 1989. 4. Transparency of inventory for affected people and asset.	1. Value of compensation will be carried out by Independent appraisal. 2. This aspiration is covered in options of resettlement. 3. PLN has target to start this project in 2011 4. Public announcement and grievance redress resolution.
15	Coordination for land acquisition plan	23 December 2010	Le Aries Hotel, Bandung	- West Bandung Bappeda - District secretary - Official officers: Dinas Kehutanan, Perum Perhutani, BPN, Subdistricts	1. Recent status of project location determination 2. Implementation of OP 4.12	1. Waiting for BPN's decision. 2. Loan Agreement as legal basis for land acquisition implementation
16	Coordination for land acquisition plan	13 January 2011	Cianjur PLN office	- Cianjur Bappeda - District secretary - Official officers: Dinas Kehutanan, Perum Perhutani, BPN, Subdistricts	1. Recent status of project location determination 2. Implementation of OP 4.12	1. Waiting for BPN's decision. 2. Loan Agreement as legal basis for carrying out the land acquisition
17	Options on relocation sites	31 January 2011 (Access Road) and 13-14 February 2011 (Lower Reservoir). 6 February 2011	Along access road row and along lower reservoir footprint Cimarel Elementary School, Cimarel Hamlet, Sukaresmi Village, Rongga sub-district, West Bandung District	Participants from PAPs who are affected the access road and lower reservoir 131 participants from PAPs who are living in the village of Tapos, Cimarel, Cipateungteung, Lembur Panjang, Lembur Sawah, Campaka, Cimanggu, Cibenda, Cilengkong, Gasintu, Cibima, Cipedes, Cilawang Hamlets and government officials from Sukaresmi village office	1. Replacement for land belongs of the forestry land that occupied by PAPs 2. Is the land without land certificate get the same compensation which are certified? 3. NJOP can't be used anymore because market price is higher than NJOP (10 times) 4. Replacement for social/ public facilities 5. Continuation school/education for children who moved their family	1. **Tabel 4.1 (entitlement PAPs) provides assistance for this group** 2. Get the same compensation but not the same value 3. The value of affected assets carried out by licensed appraiser based on market price/cost approach. 4. PLN will provide social/public facilities 5. PLN consider it and cover in the LARAP. 6. It must be paid by PAP from compensation on PAPs' affected assets

No	Theme	When	Where	Who & how many people participated	Key issues raised during the consultation	How these issues were addressed in the revised documents
					6. Is land and house free or paid? 7. People want to move by themselves	7. PLN gives a freedom to PAPs to choose the option as they need
18	Coordination for land acquisition plan	9 February 2011	West Java Province Office	- Assistance of Province Secretaries - Officials from West Java Province Office Official officers: Dinas Kehutanan, BPPT, BPN Province	Recent status of project location determination	1. Waiting for BPN's decision. 2. Legal division from West Java Province Office will review PLN's status as government entity.
19	Project information	17 February 2011	Sub-District of Rongga Office, West Bandung District	- Assistance of District Secretaries - Head commission of DPRD Commission C Official officers: district, sub-district Rongga, DPRD Commission C (local parliament).	1. Environmental issues and renewing coordination agreement between district and PLN. Such as Cisokan project should not create giant septic tank like Saguling (disposal water from Bandung city enters to Saguling) 2. Farm labour/tenants/ sharecropper should be considered for compensation on their assets	1. PLN has allocated budget for coordination and developing infrastructures in West Bandung district. Cisokan not accommodate waste water from outside and banned for fishing and farming activity due to safety reason. 2. LARAP has covered this
20	Project impact on environmental and social impact and its mitigation.	23 February 2011	Horison Hotel Bandung	86 participants from: - Universities: ITB, UNPAD, UPI - NGOs - Local medias - West Bandung District - Cianjur District - West Java Province - DPRD	1. Before the inundation needs properly information to the community nearby. 2. Biodiversity and other environmental impact 3. Recent status of project 4. Monitoring and evaluation during and post implementation 5. Many neighbourhoods nearby PLN's project do not get electricity supply. 6. Right of the people who are living on the forest land for long period from generation to generation without any sanction/warning from the forestry depart. 7. Cultural property and local wisdom should be considered	1. It has been planned in the EMP 2. It has been paid attention on the mitigation plan as part of the EMP 3. Waiting for location determination by governor 4. It has been covered in the LARAP. External monitoring will be carried out by independent and PLN for internal monitoring 5. It has been considered by PLN and PLN will supply electricity to the affected villages 6. PLN has paid attention for their livelihood and they are eligible for compensation on their assets other than land and for assistance as described in table 4.1, LARAPs 7. PLN provides compensation either on private or communal/village cemetery. Consultation is very important to hear/adopt local

No	Theme	When	Where	Who & how many people participated	Key issues raised during the consultation	How these issues were addressed in the revised documents
					8. After completion of construction, i) cashew and banyan trees suitable for conservation in quarry area; ii) palm and cashew trees suitable for cultivation in the greenbelt of upper and lower reservoirs	wisdom in the implementation of LARAP. 8. Good input and PLN will consider it.
21	i) Options on livelihood restoration and capacity building program; ii) Environment and iii) Hotline for PAPs to PLN at 0819 1046 9060 for any questions/ request information	1 March 2011	Cijambu Village office, Cipongkor Sub-District, West Bandung for PAP who are affected the access road Sukaresmi village office, Rongga Sub-District, West Bandung district for PAP who are affected the upper reservoir	40 participants from PAPs who are affected from the access road. 34 participants from PAPs who are affected the upper reservoir.	1. Livestock package for lambs is better than poultries due to avian flu risk 2. Aid for seedlings for paddies (bibit unggul) 3. Participants/PAPs who own farmland hope to buy new farmland 4. Training for prevention of poultry diseases and its treatment. 5. Training for prevention of plant pests and its treatment 6. How the PAP knows about the training package if they move by themselves 7. Accessibility for new location either provided by the PLN or chosen by themselves 8. Replacement for land belongs to forestry land that occupied by PAPs 9. Participants/PAPs prefer to move to the same village by themselves. 10. Aid for seedling for coffee and coconut and training to maintain the plants to get a good harvest 11. How to pay for land and house provided by PLN? cash, credit? 12. Why can't the community have activity close to reservoir?	1. Good input. The community can select package options as needs and local conditions. 2. PLN will consider 3. It is good to sustain the livelihood 4. PLN will consider 5. PLN will consider 6. PAPs should inform their moving/new address to the project field office (posko proyek) 7. PLN has considered about it 8. PLN has considered about it in the LARAP 9. PAP can decide their option 10. PLN will consider 11. PLN will explain these scheme during implementation 12. Due to fluctuations in water levels fluctuate dam and slide risk 13. PLN will consider

No	Theme	When	Where	Who & how many people participated	Key issues raised during the consultation	How these issues were addressed in the revised documents
					13. Training for organic fertilizer since chemicals to far away and costly	
22		4 March 2011	Margaluyu village office, sub-district Cibeber, Cianjur District for PAP who are affected the lower reservoir	110 participants from PAPs who are affected the lower reservoir.		
23	Consolidation meeting in preparation of Land Acquisition Implementation with the Provincial Government	8 March 2011 09.00	PLN Bandung Office	27 Officials from Provincial Government	1. PLN President Director has followed up BPN's letter with sending a letter to Ministry of Energy and Mineral Resources (MEMR) regarding land acquisition process. 2. New BPN regulation no 2 of 2011 concerning on technical consideration on land services 3. Gap between Indonesian laws/regulations with the WB policy	- Provincial Government will invite MEMR to discuss land acquisition process - PLN will follow the new guidelines - Indonesian laws/ regulations and the World Bank Policy will complement each other and they will be included in the loan agreement as legal basis in land acquisition implementation. - Coordination and synchronization between PLN and related governmental agencies is needed to implement the LARAPs.
24	Consolidation meeting in preparation of Land Acquisition Implementation with the Local People's Representative Council (DPRD) Commission A	8 March 2011 16.00	PLN Bandung Office	16 Officials from DPRD Commission A (West Bandung)	1. The WB was being questioned on how serious the Bank in financing the project since there has been reports from local newspaper that the Bank hesitant in financing the project due to delayed location determination 2. The project should provide economic benefits to the local community	1. The Bank said that the headline was written in Galamedia Online dated March 3, 2011 is factually incorrect. Any questions regarding the project should be asked directly to PLN or the WB. 2. The main project including new access road development will provide direct and indirect economic impacts to the districts as well as local community. Negative impact on social and environmental mitigation have been identified and planned well in the LARAPs.

No	Theme	When	Where	Who & how many people participated	Key issues raised during the consultation	How these issues were addressed in the revised documents
25	Public consultation. Pre-construction Phase 1	8 March 2016	Office PT. PLN	- Sinotech consultant - DAW-JV contractor - Principals and Teachers with a total of 75 participants and 10 school representatives (3 of whom are women) from: 1. SD Cimega 2. SD Sarinagen 3. SLB Try Medya 4. Yayasan Al-Barqunnajah 5. SD Cilawang 6. SD Cimarel 7. SMP Cimarel 8. MI Al-Tarbiyah 9. SD Girimukti 10. SD Cantrawayang	1. Construction work to be carried out 2. Traffic management including safety (dust disturbance, noise and traffic safety)	1. School representatives around the Upper Cisokan Hydroelectric Power Plant Roadway who were present at the public consultation has understood the construction work and traffic management of the UCPS Hydroelectric Power Plant construction.
26	Public consultation. Pre-construction Phase 2	18 March 2016	Office PT. PLN UIP VI	- West Bandung Regency Resettlement Implementation Team - Cipongkor District (Sarinagen Village, Cijambu Village and Sirnagalih Village) - Rongga District (Cibitung Village, Sukaresmi Village, Bojongsalam Village and Cicadas Village) - Sinotech consultant - DAW-JV - PT. UIP VI - PT. UPKP Hydro I - The number of participants who attended was 35 people (3 of them were women)	1. Construction work to be carried out 2. Traffic management including safety (dust disturbance, noise and traffic safety) 3. Safety Health Management including HIV / AIDS 4. Workers Camp Management 5. Biodiversity Management Plan 6. Job / Business Opportunities 7. Mechanisms for submitting complaints / complaints 8. Camp followers	1. Regional government representatives around the Upper Cisokan Hydroelectric Power Plant Roadway who were present at the public consultation event understood the construction work and traffic management of the UCPS Hydroelectric Power Plant construction.
27	Public consultation. Pre-construction Phase 3	24 May 2016	Office of PT. PLN UIP JBT I	- Cipongkor District Representative - Sindangkerta Police Chief - Danramil Sindangkerta - Village Heads and residents of Karangsari, Sarinagen, Cijambu and Sirnagalih Villages A total of 34 participants attended	1. Construction work to be carried out 2. Traffic management including safety (dust disturbance, noise and traffic safety)	1. Regional government representatives around the Upper Cisokan Hydroelectric Power Plant Roadway who were present at the public consultation event understood the construction work and traffic management of the UCPS Hydroelectric Power Plant construction.

No	Theme	When	Where	Who & how many people participated	Key issues raised during the consultation	How these issues were addressed in the revised documents
28	Public consultation. Pre-construction Phase 4	26 May 2016	Hall of Karangnunggal Village	- Camat Cibeber - Kapolsek Cibeber - Danramil Cibeber - Kepala Desa dan warga Desa Karangnunggal - Kepala Desa dan warga Desa Girimulya A total of 33 participants attended	1. Construction work to be carried out	1. Regional government representatives around the Upper Cisokan Hydroelectric Power Plant Roadway who were present at the public consultation event understood the construction work and traffic management of the UCPS Hydroelectric Power Plant construction.
29	Public consultation. Pre-construction Phase 5	2 June 2016	Hall of Sukaresmi Village	- Kapolsek Gununghalu - Danramil Gununghalu - Kepala Desa dan perwakilan warga Desa Cibitung - Kepala Desa dan perwakilan warga Desa Sukaresmi - Kepala Desa dan perwakilan warga Bojongsalam - Kepala Desa dan perwakilan warga Cicadas A total of 95 participants attended	1. Construction work to be carried out	1. Regional government representatives around access road of the Upper Cisokan Hydroelectric Power Plant who were present at the public consultation event had understood the construction work and traffic management of the UCPS Hydroelectric Power Plant construction.
30	Public consultation ESIA dan LARAP 2020	30 September 2020	Online & Offline Meeting	- The public consultation was held on 30 September 2020, using the online Zoom meeting platform and in-person in 5 locations, namely the Bappeda Office of West Bandung Regency, Rongga District, Cipongkor District, Haurwangi District, and Bojongpicung District	- Inventory result data from environmental and social monitoring reports - Assessment and management of environmental and social risks and impacts - Acquisition of people's land used in the project (from now on referred to as aspects of LARAP) - Boundary Determination of project-affected people or PAPs - Risk determination of the UCPS project to the social and economic life of the people in the affected area - Assessment of the project's impact on cultural heritage - Assessment of stakeholder engagement - Legislative aspects include the laws and regulations that have	- There are community lands in 5 villages which are the affected areas. There are different perceptions regarding the legal aspects related to the value of the community land for replacement. - Replacement of village assets and village treasury lands, especially in locations adjacent to the project site in the Cijambu village area, can continue - Social impact of workers entering the project site - Expectations for community involvement in the Upper Cisokan project - There is synergy with irrigated areas, especially Cihea and Cikondang, considering that the Cianjur area is a food barn for rice producers that utilizes irrigation channels. - Expectations regarding synergy in community empowerment

No	Theme	When	Where	Who & how many people participated	Key issues raised during the consultation	How these issues were addressed in the revised documents
					been established by the government and become the legal basis for the preparation of the ESIA for the Development of the Upper Cisokan Pumped Storage (UCPS) Hydropower Plant.	- Hope for the continuity of the road access construction process that has just been built 900m - Expectations for completing the replacement of the remaining land and community lands in the Sukaresmi village area. - Expectations for the realization of cooperatives - Expectations for community involvement in the Upper Cisokan project - Post access road work has an impact on building construction damage and private property - Expectations for proper guidance and management related to the PAP cooperative - Hope for community development program completion priority - Expectations for clarity of targets regarding activities related to the development of Upper Cisokan

CHAPTER 9. METHODOLOGY FOR IMPACT ASSESSMENT

9.1 Impact Assessment

Initially, the Environmental and Social Impact Assessment (ESIA) involves identification of a project's activities and potential environmental and social impacts resulting from impact pathways operating of each project phase, which may include site preparation, construction, reinstatement, operation and decommissioning. The ESIA also encompasses planned routine activities; planned, but non-routine activities; and unplanned or accidental events.

An impact is defined as 'any change to the physical, biological or social environment, whether adverse or beneficial, wholly or partially resulting from an organization's activities, products or services. An impact may be the result from any or all project activities of the project phases.

Identifying impacts starts by scoping and continues through the ESIA. The core activity of an ESIA is the prediction, evaluation and mitigation of impacts. Prediction of impacts is essentially an objective exercise to determine what could potentially happen due to the development of the Project and its associated activities. The diverse range of potential impacts considered in the ESIA process results in a wide range of prediction methods being used including quantitative, semi-quantitative and qualitative techniques.

The types of impacts considered have been categorized according to their various characteristics (for example, are they detrimental or beneficial, direct or indirect, etc.). Impacts arise as a result of project activities either through direct interaction or by causing changes to existing conditions such that an indirect effect occurs. Accurate identification of potential impacts is the critical first step within the impact assessment process.

At this stage within the assessment process, all issues are screened, and a judgement made as to whether the potential impacts are of sufficient magnitude to cause a measurable impact. Where an impact is deemed to be so small as to be insignificant, no further consideration will be given to them during the assessment process.

It is important to note that impact prediction takes into account any mitigation or control measures that are part of the project design (e.g., acoustic enclosures for major equipment). Additional mitigation measures, aimed at further reducing predicted impacts, are proposed where necessary or appropriate.

Table 39 defines the terminology used for the ESIA assessment methodology.

Table 39. Impact Assessment Terminology

Term	Definition
Impact Magnitude	
Magnitude	Estimate of the size of the impact (e.g. the size of the area damaged or impacted, the % of a resource that is lost or affected etc.)
Impact Nature	
Negative Impact	An impact that is considered to represent an adverse change from the baseline, or introduces a new undesirable factor
Positive Impact	An impact that is considered to represent an improvement on the baseline or introduces a new desirable factor

Term	Definition
Neutral Impact	An impact that is considered to represent neither an improvement nor deterioration in baseline conditions
Impact Duration	
Temporary	Impacts are predicted to be of short duration and intermittent/ occasional in nature
Short-term	Impacts that are predicted to last only for a limited period (e.g., during construction) but will cease on completion of the activity, or as a result of mitigation/ reinstatement measures and natural recovery
Long-term	Impacts that will continue over an extended period (e.g., operational noise) but cease when the project stops operating. These will include impacts that may be intermittent or repeated rather than continuous if they occur over an extended time period
Permanent	Impacts that occur once on development of the project and cause a permanent change in the affected receptor or resource (e.g., the destruction of a cultural artefact of loss of a sensitive habitat) that endures substantially beyond the Project lifetime
Impact Extent	
Local	Impacts are on a local scale (e.g., restricted to the vicinity of the plant, i.e. restricted to within the project area)
Regional	Impacts are on a broader scale (effects extend well beyond the immediate vicinity of the facilities and affect the larger region, in this case western Java)
International	Impacts are on a global scale (e.g., could extend beyond national boundaries/affect existence of species)
Impact Type	
Direct Impact	Impacts that result from a direct interaction between a planned project activity and the receiving environment (e.g., between occupation of a plot of land and the habitats which are lost)
Secondary Impact	Impacts that follow on from the primary interactions between the project and its environment as a result of subsequent interactions within the environment (e.g., loss of part of a habitat affects the viability of a species population over a wider area)
Indirect Impact	Impacts that result from other activities that are encouraged to happen as a consequence of the project (e.g., presence of project promotes service industries in the region)
Cumulative Impact	Impacts that act together with other impacts to affect the same environmental resource or receptor
Residual Impact	**Impacts that remain after mitigation measures have been designed into the intended activity**

Assessment of the significance of the impacts requires consideration of the likelihood and magnitude of the environmental or social effects; the geographical scale and duration in relation to the sensitivity of the key receptors and resources are also considered. Criteria for assessing the significance of impacts stem from the following key elements:

1. Magnitude of Impact
2. Sensitivity of Receptor
3. Likelihood of Impact
4. Severity of Impact

9.1.1 Magnitude of Impact

The magnitude (including nature, scale and duration) of the change to the natural environment (for example, loss or damage to habitats or an increase in noise), which is expressed in quantitative terms wherever practicable.

Magnitude is categorized as follows:

- No change
- Slight
- Low
- Medium
- High

9.1.2 Sensitivity of Receptor

The nature of the impact receptor, which may be physical, biological, or human. Where the receptor is physical (for example a body of water) its quality, sensitivity to change and importance are considered. Where the receptor is biological, its importance (be it local, regional, national or international) and its sensitivity to impact are considered. For a human receptor, the sensitivity of the community or wider societal group is considered along with its ability to adapt to and manage the effects of the impact.

Sensitivity of receptor is categorized as:

- Low
- Low-Medium
- Medium
- Medium-High
- High

9.1.3 Likelihood of impact

The Likelihood (probability) of Impact identified is estimated based upon experience and/or evidence that such an outcome has previously occurred. The likelihood categories are shown in Table 40.

Table 40. Likelihood Categories

Likelihood	Definition
Extremely unlikely	**The event is very unlikely to occur under normal operating conditions but may occur in exceptional circumstances, i.e. the event is generally never heard of in industry**
Unlikely	**The event is unlikely but may occur at some time during normal operating conditions, i.e. the event is heard of in industry**
Low Likelihood	**The event is likely to occur at some time during normal operating conditions, i.e. incident has occurred in the company before**
Medium Likelihood	**The event is very likely to occur during normal operating conditions, i.e. the event occurs several times per year in the company**

High Likelihood / Inevitable	**The event will occur during normal operating conditions (is inevitable), i.e. the event happens several times per year at a location**

9.1.4 Severity of Impact

The Severity of Impacts is then devised from a combination of the Sensitivity of the Receptor and the Magnitude of Impact (Table 41).

Table 41. Determining the Severity of Impacts

		Sensitivity of Receptor				
		Low	**Low-Medium**	**Medium**	**Medium-High**	**High**
Magnitude	**No Change**	Slight	Slight	Slight	Slight	Slight
	Slight	Slight	Slight	Low	Low	Low
	Low	Slight	Low	Medium	Medium	Medium
	Medium	Low	Medium	High	High	High
	High	Medium	High	High	Very High	Very High

9.1.5 Significance of Impact

The Significance of Impact is determined by evaluating the Severity of Impact and the Likelihood of Impact, and the Likelihood of Impact (Table 42). Planned events will be those with high or inevitable likelihood – i.e., 100% chance of occurrence.

Table 42. Determining the Significance of Impacts

		Impact Likelihood				
		Extremely Unlikely	**Unlikely**	**Low Likelihood**	**Medium-Likelihood**	**High Likelihood / Inevitable (Planned Event)**
Impact Severity	**Slight**	Negligible	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Negligible	Negligible	Negligible - Minor	Minor
	Medium	Negligible	Minor	Minor	Minor - Moderate	Moderate
	High	Minor	Minor - Moderate	Moderate	Major	Major
	Very High	Minor – Moderate	Moderate-Major	Major	Major	Critical

Table 43 describes the Significance of Impact definitions relative to ranking of importance.

Impacts assessed as Negligible or Minor will require no additional management or mitigation measures on the basis that the magnitude of the impact is sufficiently small, or that the receptor is of low sensitivity and/ or that adequate controls are already included in the Project design. Negligible and Minor impacts are therefore deemed to be "Insignificant" and fall within the "No Action" criterion.

Impacts evaluated as Moderate or Major require the implementation of further management or mitigation measures. Major and Moderate impacts are therefore deemed to be "Significant".

Major impacts always require further management or mitigation measures to minimize or reduce the impact to an Acceptable Level. A generally "Acceptable Level" is the reduction of a Major impact to a Moderate one after mitigation. Where Major impacts cannot be reduced further, a range of additional measures will be needed, including repair and remedy during either the operational or closure phase (such as the rehabilitation of mining pits to replace biodiversity losses, or removal of Project infrastructure during the closure phase in the case of visual impacts), community development programs and/or the implementation of a biodiversity offset strategy.

Table 43. Definition of Significance of Impact

Significance	*Definition*
Positive Impact	An impact that is considered to represent an improvement on the baseline or introduces a new desirable factor
Negligible Impact	Magnitude of change comparable to natural variation
Minor Impact	Detectable but not significant
Moderate Impact	Significant; amenable to mitigation; should be mitigated where practicable
Major Impact	Significant; amenable to mitigation; must be mitigated
Critical Impact	Intolerable; not amenable to mitigation; alternatives must be identified - Project Stopper

In seeking to mitigate Moderate impacts, the emphasis is on demonstrating that the impact has been reduced to a level that is As Low As Reasonably Practicable (ALARP). It will not always be practical to reduce Moderate impacts to Minor ones due to the cost-ineffectiveness of such an approach (due to the diminishing return of a reduction of impact versus cost).

Impacts evaluated as Critical cannot be managed or mitigated and require the identification of alternatives (elimination of source of potential impact). Such impacts are Intolerable and could potentially result in abandonment of a project (potential "project stoppers").

9.2 Mitigation Measures

A key element and outcome of the ESIA process is to explore and develop practical measures of avoiding, reducing or offsetting potential impacts associated with the Project. These are commonly referred to as mitigation measures and will be incorporated into the Project either as direct design measures, or as commitments to be implemented at various stages throughout the Project. Mitigation is aimed at preventing, reducing or managing significant negative impacts to ALARP and maximizing any potential benefits of the Project, where applicable. For the purposes of this ESIA, ALARP is defined as the point at which the cost and effort of further risk reduction is grossly disproportionate to the risk reduction achieved.

The approach taken for identifying and incorporating mitigation measures into the Project is based on a typical hierarchy of decisions and measures, as outlined below. This is aimed at ensuring that, wherever possible, potential impacts are mitigated rather than corrected through restoration after the impact has occurred. Thus, the majority of mitigation measures fall within the upper two tiers of mitigation hierarchy and are effectively built into the planned Project.

1. **Avoid at Source**; Reduce at Source - Avoiding or reducing at source is essentially 'designing' the project so that a feature causing an impact is designed out (e.g., a waste stream is eliminated) or altered (e.g., reduced waste volume) - often called minimization.

2. **Abate on Site** - This involves adding something to the basic design or procedures to abate the impact -. often called 'end-of-pipe'.

3. **Abate at Receptor** - If an impact cannot be abated on-site, then measures can be implemented off-site

4. **Repair or Remedy** - Some impacts involve unavoidable damage to a resource, e.g., land disturbance or shoreline pollution arising from poor erosion and sediment control management. Repair essentially involves restoration and reinstatement type measures, such as base camp closure or, in the case of surface erosion that has reached the ocean, clean-up of the shoreline.

5. **Compensate in Kind** - Where other mitigation approaches are not possible or fully effective, then compensation, in some measure, for loss, damage and general intrusion might be appropriate. An example could be compensation for loss of earnings if fisheries were to be temporarily or permanently impacted by a project activity, or where direct resettlement and compensation payments are required. Another example would be the development of biodiversity and carbon offsetting programs where the mitigation of impacts cannot be undertaken within the confines of the Contract of Works.

CHAPTER 10. ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT – CONSTRUCTION PHASE

10.1 Introduction

The environmental and social impacts associated with major construction activities (construction of upper dams, lower dams, and other supporting facilities, quarry operations, construction of transmission networks) are discussed in this section.

The following list is an outline of the environmental and social impacts that are expected to occur when construction activities are carried out at the UCPS for the dams and reservoir:

- Impact on river ecosystem and water quality
- Impact on erosion and sedimentation levels
- Impact on air quality
- Noise pollution
- Impact of vibration
- Water pollution in the Gunung Karang quarry
- Impact on biodiversity
- Impact on socio-economic aspects in the surrounding community
- Potential impacts on health and safety

Each impact is described further in each section in this chapter.

10.2 Environmental Impact of the Construction Stage

Impact prediction is a screening process of several potential impacts that may occur in connection with the construction activity process. The process of identifying potential impacts for each environmental parameter was carried out using quantitative and qualitative methods and will be used as the basis for determining the mitigation that must be carried out to minimize and prevent impacts. This follows the key objective of ESS 6, "to protect and conserve biodiversity and habitats", by applying the mitigation hierarchy and the precautionary approach in the design and implementation of projects that could have an impact on biodiversity.

10.2.1 Erosion and Sedimentation

Earthworks in the watershed and in riverbeds, including vegetation clearance, reservoir preparation, slope stabilization and landslide removal, blasting, excavation, filling and quarry operations, will contribute to the movement of large amounts of exposed soil and rock around the project site. The risk of erosion is considered high, given the steep topography, high levels of rainfall and heavy river flows during the rainy season, the scale of earthworks, and the excessive loads in the area (Table 38).

The potential impact of erosion is the flow of sediment into the river system. Sediment can impact habitats and aquatic organisms when the sediments are suspended in the water and are deposited on riverbeds and riverbanks.

Currently the river experiences high levels of turbidity and sediment loads, evidenced by the mud and sand deposition in the deep river basins, and the color change in the Cisokan River between the wet and the dry season.

Table 44. Potential Impacts on Water Bodies Due to Sediment Disturbance during Construction

Construction Activity	Environment Response	Flow Impact
Vegetation clearance Earthworks Stream work River cliff work Road construction Excavation of the borrow pit Landfill Tunnel wastewater Clearing reservoir land Open work areas and wastewater	1. A stream with an additional concentration of suspended solids entering the water stream.	Reduced water clarity and appearance Reduced light entering which results in reduced primary productivity (reduced food and reduced habitat for invertebrates, fish and birds), and reduced processing of photosynthesis. Reduced number of aquatic invertebrates due to downstream drift. Erosion and stability of river banks Damage to the fish's gills and mouthparts Reduced visibility and fish avoidance, affecting migration, food and breeding. Reduced water quality for horticulture, water supplies and supplies for other water uses. Small changes in water temperature
	2. Increased sedimentation of fine materials on riverbeds	Plankton disruption, reducing primary production and basic animal foraging abilities. Reduced nesting habitat for fish and adversely affects the ability of fish eggs to reach adulthood. Reduced ability of fish to eat benthic invertebrates. Changes in river flow, shelter and water depth and flow by creating obstruction and filling of river basins that add to the potential for flooding. Sources of sediment for buffering and carried downstream, affecting further deposition. Changes in sediment input with high organic material that can reduce dissolved oxygen, resulting in fish/invertebrate mortality. Covering of rock faces which can reduce habitat for invertebrates. This could have an impact on changes in the number and types of existing invertebrate species from sensitive species to more tolerant species such as snails. This, in turn, could lead to changes in fish populations due to reduced food species.

Analysis of the potential change to the rate of erosion during construction uses the USLE (Universal Soil Loss Equation) approach. The calculation is based on the pattern of land changes that have occurred to open land due to the construction of the upper dam, lower dam and their supporting facilities. The construction activities are located in 4 villages, namely Bojong Village, Cinengah Village, Karangnunggal Village and Sukaresmi Village. The potential for erosion that occurs in the existing conditions and during construction in the four villages is shown in Table 45.

Table 45. Potential Erosion at Major Construction Sites

No.	Village Name	District	Existing Potential Erosion(ton/year)	Construction Potential Erosion (ton/year)	Increase of Erosion (%)
1.	Bojong	Rongga	26,206.26	40,271.97	54
2.	Cinengah	Rongga	20,939.98	49,638.61	137
3.	Sukaresmi	Rongga	53,409.49	213,474.47	300
4.	Karangnunggal	Cibeber	4,984.19	8,419.81	69

The potential annual erosion rates that occur in existing conditions and during construction are shown in Table 46.

Table 46. Potential Erosion Rate at Major Construction Sites

No.	Village Name	District	Potential Existing Erosion Rate (ton/ha/year)	Potential Construction Erosion Rate (ton/ha/year)	Classification	
					Existing	**Construction**
1.	Bojong	Rongga	13.71	21.07	Very Mild	Mild
2.	Cinengah	Rongga	26.93	63.84	Mild	Moderate
3.	Sukaresmi	Rongga	41.27	164.95	Mild	Moderate
4.	Karangnunggal	Cibeber	15.92	26.89	Mild	Mild

The potential rate of erosion at each location is then classified based on the erosion rate class according to Suripin, 2001. The classification of erosion rates is divided into classes (Figure 97).

Erosion Class	Erosion Rate	Category
I	<15	Very Mild
II	15-60	Mild
III	60-180	Moderate
IV	180-480	Heavy
V	>480	Very Heavy

(Suripin, 2001)

Figure 97. Erosion Rate Classification

Based on the table of erosion rates, it can be seen that construction activities increase the potential for erosion rates at each location. When viewed from the classification of erosion rates, construction activities that will be carried out have an impact on class changes in three locations. Class I changes to class II in Bojong Village, and from II to III in Cinengah and Sukaresmi villages. The erosion class in Karangnunggal Village is still class II.

The distribution of erosion rates based on the classification at the construction site is shown in Figure 98.

Erosion that occurs on the land surface, due to construction activities, is in the encircled area on the map. There are two key impacts from erosion:

1) Loss of productive soils for agriculture, forestry, and for natural forest restoration.

2) Contribution of sediment to water ways, affecting water quality, river ecosystems and aquatic biota.

The first impact is assessed in this section (Table 47). The second impact is discussed in the Section below (Aquatic Habitat and Water Quality).

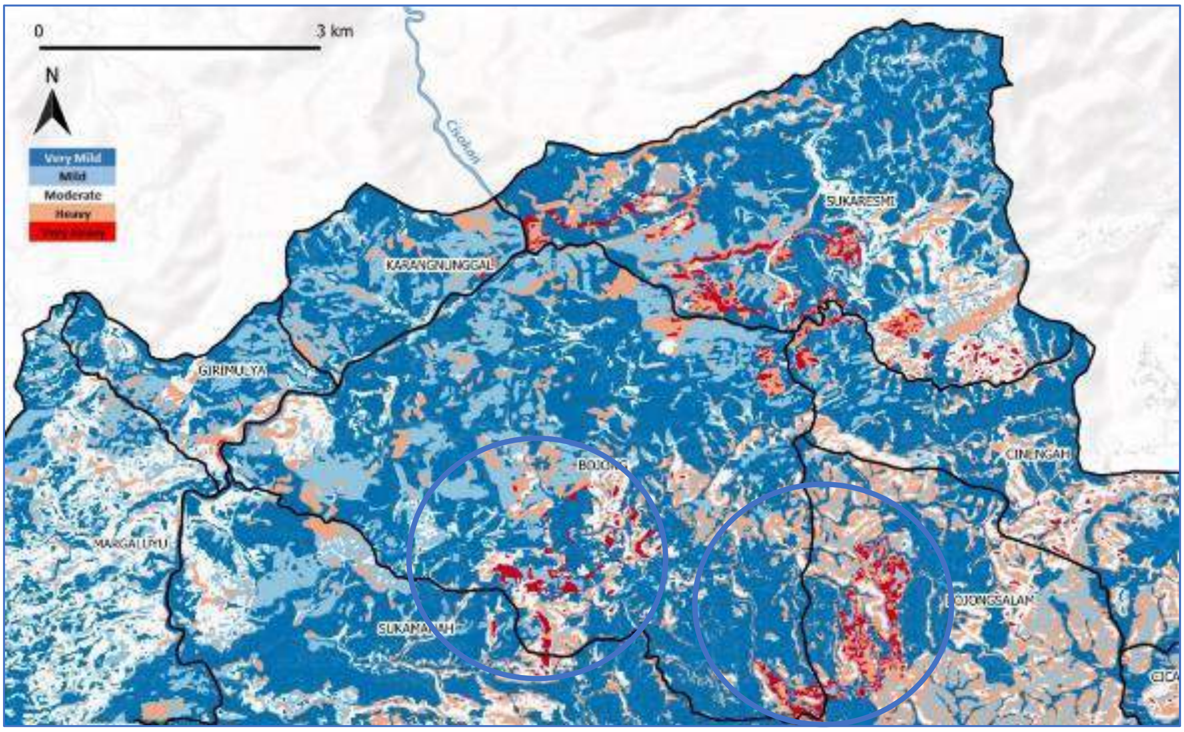

Figure 98. The distribution of the erosion rate based on the classification

Table 47. Soil Loss and Productivity Impact Assessment

Impact	Loss of productive soils for agriculture, forestry and for natural forest restoration				
Impact Nature	Negative	Positive	Neutral		
	Land use change causes increased erosion. Erosion results in the loss of topsoil, soil fertility, soil structure and slope stability. This changes the ability for the land to produce food and trees. Changes in soil and slope stability will change the plant species that would naturally colonise the areas. It can lead to changes in plant communities, introduce weed species, and reduce long term biodiversity.				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	Direct impacts due to the loss of topsoil and changes in soil structure, stability and fertility are the plant recolonisation, and agricultural and livelihood opportunities.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	Loss of topsoil, soil structure and fertility impacts are considered long-term as it can be mitigated, but this process takes a long time.				
Impact Extent	Local	Regional	Global		
	The extent of soil loss / erosion is localised to the project footprint.				
Impact Magnitude	No change	Slight	Low	Medium	High
	The calculation results show that the erosion rate that occurs as a result of the UCPS construction activities is still in the mild to moderate erosion rate (class II and III)..				
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
	The land is steep meaning erosion, landslides and unstable slopes are common, due to topography, 'young' soils and recent deforestation and slash and burn agriculture.				
Impact Severity	Slight	Low	Medium	High	Very High
	Impact magnitude medium and receptor sensitivity low-medium resulted in impact severity medium.				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood/Inevitable

Significance	Increased erosion and soil loss is inevitable. Much of the construction work is purposefully removing soil and rock, landslides etc.				
	Negligible	Minor	Moderate	Major	Critical
	The impact severity of medium with high likelihood resulted in Moderate significance.				

10.2.1.1 Cisokan River and Cilenkong River

The increase in the rate of erosion and sedimentation in the Cisokan river and Cilenkong River is influenced by land clearing activities and construction activities. The Cilenkong River will receive sediment, stormwater run-off and pollutants from works in the tunnel outlets, underground powerhouse works, switchyard, access roads, and workshops. The sediment discharge could be significant if erosion is not controlled and treated. The Cisokan River, upstream of the coffer dams, will receive sediment, stormwater run-off, pollutants from spoil banks and access roads, and sediments and pollutants from the upper dam works, via the Cirumamis River.

The location of the lower dam construction activities is in the areas of Karangnunggal village and Sukaresmi village. Based on the table, the potential increase in the rate of erosion that occurred in Karangnunggal village reached 69%, while in the Sukaresmi village area it increased by 300% from pre-construction conditions. The increase observed in Sukaresmi Village is a contribution from construction activities both at the lower and upper dam.

Fine sediments will enter the Cilenkong and Cisokan River water and be diverted through the diversion tunnel around the lower dam site and discharged downstream, in the Cisokan River. Coarse sediments will settle on the river bed, changing the ecosystem, and / or captured by the upstream coffer dam, and will not be discharged downstream. Sediment and pollutants from dam foundation excavations and blasting, slope stabilization and dam construction, will be trapped by the downstream coffer dam and will not be discharged downstream into the Cisokan River.

In the absence of treatment measures, the eroded soil material will enter the Cisokan river body via the diversion tunnel, which results in an increase in TSS value and sedimentation. The increase in the amount of sediment in the Cisokan river may increase the amount of sediment caught in the sediment traps in the Cisokan Dam for the Cihea Irrigation Scheme (Cisuru weir). The impact assessment of erosion and sedimentation in the Cisokan river is shown in Table 48.

Table 48. Erosion and Sedimentation Impact Assessment of Cisokan and Cilenkong Rivers in Construction Stage

Impact	An increase in the rate of erosion, which results in a decrease in water and river ecosystem quality in the Cisokan and Cilenkong Rivers.				
Impact Nature	Negative	Positive	Neutral		
	Land use change causes increased erosion. The products of erosion will be discharged directly into water ways, or carried by water when surface runoff occurs, and will be suspended in water, degrading water quality, before being deposited on the river banks or beds. This is a natural process in river systems but the pattern and rate of sediment deposition will change as a result of UCPS.				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual

	Erosion that occurs due to changes in land use and land clearing activities during construction. Erosion occurs when rain falls on the land surface which then becomes surface runoff which erodes and carries surface material from the construction site that later settles in the Cisokan and Cilenkong Rivers body.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	The increased sediment load and turbidity, caused by the UCPS construction activities, will only last for the ± 4 years of construction activities. Sediment deposition and ongoing resuspension and movement of sediment down the Cisokan River may continue for many years after construction, but the pattern and rate will be affected by the operation of the scheme. These impacts are discussed in the operational phase section.				
Impact Extent	Local	Regional	Global		
	The impact caused by the erosion-sedimentation process, observed predominantly in the catchment area,takes the form of decreased land fertility, and decreased water and river ecosystem quality. The decline in water and river ecosystem quality, due to erosion-sedimentation, was identified to occur from the UCPS area to the downstream part of Cisokan River, at the Cirata reservoir.				
Impact Magnitude	No change	Slight	Low	Medium	High
	The calculation results show that the erosion rate, caused by the UCPS construction activities, is still in the mild to moderate erosion rate class.				
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
	Sedimentation increases turbidity in the Cisokan and Cilenkong Rivers water. However, the impact on aquatic biota is not that great because the existing conditions in the rainy season Cisokan and Cilenkong Rivers have a high level of turbidity. All species are tolerant of high turbidity. The impact on humans is low because most of the Cisokan and Cilenkong Rivers is used for agricultural irrigation which is less sensitive to turbidity compared other water uses.				
Impact Severity	Slight	Low	Medium	High	Very High
	Impact magnitude medium, and receptor sensitivity low-medium, resulted in impact severity medium.				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood/Inevitable
	Increased erosion and sedimentation due to contractor activities will generally occur in construction projects.				
Significance	Negligible	Minor	Moderate	Major	Critical
	The impact severity of medium, with medium likelihood, resulted in moderate significance				

10.2.1.2 Cirumamis River

The increase in the rate of erosion and sedimentation that occurs in the Cirumamis river is influenced by the activity of land clearing and the dam construction process on the UCPS. The results of the analysis of the potential amount and rate of erosion that will have an impact on the Cirumamis river can be seen in the changes that have occurred in Bojong Village, Cinengah Village, and Sukaresmi Village. The potential increase in the amount and rate of erosion, due to the UCPS construction activities in Bojong Village, was 54%, Cinengah Village 137%, and Sukaresmi Village 300% compared to pre-construction conditions. Without prevention activities, the eroded land will enter the Cirumamis River body and flow into the Cisokan river body. The impact assessment on the increased rate of erosion and sedimentation in the Cirumamis river, during the construction stage, is shown in Table 49.

Table 49. Erosion and Sedimentation Impact Assessment of Cirumamis River in Construction Stage

Impact	Increasing rate of erosion resulting in a decrease in water and river ecosystem quality in the Cirumamis river				
Impact Nature	Negative	Positive	Neutral		
	Land use change leads to increased erosion. The erosion is caused by surface runoff and results in deposition or sedimentation of material in the Cirumamis river body.				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	Erosion occurs due to changes in land use and land clearing activities during construction.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	The increased contribution of sediment and turbidity, caused by the UCPS construction activities, will only last for the ± 4 years of construction activities. Sediment deposition and ongoing resuspension and movement of sediment down the waterfalls of the Cirumamis River to the lower reservoir may continue for many years after construction, but the pattern and rate will be affected by the operation of the scheme. These impacts are discussed in the operational phase section.				
Impact Extent	Local	Regional	Global		
	The impact caused by the erosion-sedimentation process, namely in the catchment area, in the form of decreased water and ecosystem. The decline in quality due to erosion-sedimentation has been predicted to occur from the downstream area of the Cirumamis river, the Cisokan river and the downstream area to the Cirata reservoir.				
Impact Magnitude	No change	Slight	Low	Medium	High
	The calculation results show that the erosion caused by the UCPS construction activities is still in the mild to moderate erosion rate class and will have a medium magnitude impact compared to the baseline conditions.				
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
	Sedimentation increases turbidity in the water and some coarse sediment may accumulate in pools at the bottom of waterfalls, changing the pool habitat. The waterfall environment already receives sediment in the wet season and is swift flowing, so most fine sediments will be flushed down into the Cisokan River.				
Impact Severity	Slight	Low	Medium	High	Very High
	Impact magnitude medium, and receptor sensitivity low-medium, resulted in impact severity medium.				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood/Inevitable
	Increased erosion and sedimentation, due to contractor activities, will generally occur in construction projects.				
Significance	Negligible	Minor	Moderate	Major	Critical
	The impact severity of medium with high likelihood resulted in moderate significance				

The results of the impact assessment, for sediment erosion in the Cisokan and Cirumamis rivers, show a moderate significance impact. The large-scale land clearing and river works for this project has the potential for sediment discharge into rivers that exceeds current sediment conditions. Based on these results, the impacts that arise can be reduced by taking mitigation measures. Details of the mitigation that must be done to reduce these impacts are discussed in Chapter 12 regarding the environmental and social management plan.

10.2.1.3 Cijambu River

The increase in the rate of erosion and sedimentation, that occurs in the Cijambu river, is influenced by activities on the main access road. Fine sediments will be discharged into tributaries through stormwater. Spilled material, transported by dump trucks, has the potential to fall along the delivery road to the main construction site. This material will be carried away by run off which enters the Cijambu river body and flows into the Saguling reservoir body. The impact assessment on increased sedimentation in the Cijambu river during the construction phase is shown in Table 50.

Table 50. Impact Assessment of Sedimentation in Cijambu River

Impact	Increased sedimentation resulted in a decrease in water and river ecosystem in the Cijambu River				
Impact Nature	Negative	Positive	Neutral		
	Material spills and fine dust on the road will be carried by water when surface run-off occurs and will be deposited or become sedimentation material in the Cijambu River				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	Occurs when rain falls on the road surface which then becomes surface run-off, carrying material that enters the Cijambu River				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	Increased sedimentation and decreased quality of water due to activities on the access road will only last for the ±4 years of construction activities.				
Impact Extent	Local	Regional	Global		
	Increased sedimentation and decreased water quality, as an impact caused by the entry of sediment into the river body, were identified to occur in the Cijambu river to the Saguling reservoir.				
Impact Magnitude	No change	Slight	Low	Medium	High
	The impact of increased erosion and sediment flow into the Cijambu River is not too large, as it is not generated from the land clearing activities, but only from sediment-laden stormwater and material falling / spilling on the main access road.				
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
	Sedimentation increases the turbidity of Cijambu River. However, the effect on aquatic biota is not that great because the existing conditions in the rainy season Cijambu River have a high level of turbidity.				
Impact Severity	Slight	Low	Medium	High	Very High
	Impact magnitude low, and receptor sensitivity low-medium, shows the impact severity to be low.				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood/Inevitable
	The sediment-laden stormwater will be an ongoing impact for the duration of the road use. Material spills are unlikely, but overall impacts are inevitable.				
Significance	Negligible	Minor	Moderate	Major	Critical
	A low impact severity and high likelihood resulting in a Minor Significance				

Based on these results, the impact is not significant. Management efforts can be carried out by monitoring the water quality in the Cijambu river.

10.2.2 Aquatic Habitat and Water Quality

Construction activities in the UCPS area are likely to have a negative impact on water quality and river habitats. There are three rivers which will potentially experience a decrease in water quality and a change to river habitat as a result of construction activities, namely the Cisokan River, the Cirumamis River and the Cirendeu River.

10.2.2.1 Physical changes to river habitat

Damage and physical change to rivers and riparian areas during construction will arise from:

- Slope and bank stabilization, diversion tunnel portal construction, coffer-dam installation, excavations for dam foundations, and dam building;
- Landslides where slopes are not adequately stabilized;
- The diversion of water flow around work areas at the lower and upper dams, via tunnels and culverts creating dry areas, providing a barrier to fish movement, changing the way flood flows carry and deposit sediment, and potential for scour and erosion at the discharge points;
- Road crossings/culverts/bridges;
- Diversion of small water course around work areas; and
- Removal of riparian vegetation cover, thereby increasing water temperature and light exposure.

10.2.2.2 Sedimentation

The sources and types of sediment that may enter the rivers and tributaries and affect water quality and aquatic biota are:

- Sediment (fine and coarse), organic matter, and nutrients from vegetation clearance and earthworks on slopes adjacent to the rivers and tributaries.
- Sediment (fine and course) from the earthworks, tunnelling and construction works within the rivers and riverbanks.
- Sediment (fine and coarse) from spoil disposal and stockpiles carried by stormwater run-off.
- Sediment (fine) in stormwater run-off from in and around open/exposed work areas, roads, quarry and work areas.

10.2.2.3 Pollutants

The sources and types of pollutant that may enter the rivers and tributaries and affect water quality and aquatic biota are:

- High pH suspended solids from cement storage and concrete batching areas.
- High pH heavy metals, hydrocarbons and suspended solids from fly ash storage and handling.
- Hydrocarbons, heavy metals, and nutrients, from spills, deliberate discharge, and poor storage, handling and disposal of hazardous materials, fuels, and waste oils, including those that may induce pH changes. These pollutants also come from untreated stormwater run-off from working areas.
- Solid waste from littering and poor handling of waste.

10.2.2.4 Domestic waste

The sources and types of domestic waste that may enter the rivers and tributaries, and affect water quality and aquatic biota are:

- Organic material, pathogenic bacteria and nutrients from poor siting and management of the Contractor's sewage treatment facilities, including siting of septic tanks that could lead to seepage to rivers.

- Organic material, pathogenic bacteria and nutrients from untreated sewage from informal settlements, camp followers and field-based defecation.

Increasing domestic waste with the key parameters BOD, COD and TSS could cause a decrease in the quality of water bodies, thus reducing the quality of habitat for aquatic organisms. The results of the measurement of water quality in several rivers showed that the levels of BOD and COD were above the quality standard, particularly those contaminated with domestic waste. This shows that the management of domestic waste by the community is low, due to the limited facilities for collecting waste from baths, washing and latrines (gray water and black water), meaning that most of the domestic waste is channeled directly into water bodies. The construction phase will involve the arrival of many workers with the potential to increase domestic waste discharge to water bodies. Hopefully, such increases will be mitigated by adequate environmental sanitation facilities in camps and at works. The results of the analysis of pollution predictions, using pollution load analysis (Directorate General of Pollution Control and Environmental Damage, Ministry of Environment and Forestry, 2018), calculated based on the emission standards discharged by each person per day for BOD, COD parameters, indicate that the increase in construction stage workers will increase domestic waste by 4.4% at peak work periods.

10.2.2.5 Water quality in Cisokan River and Cilenkong River

During construction, the Cisokan River, immediately downstream of the Cilenkong River confluence, will be modified by the installation of upstream and downstream coffer dams, and the diversion of water for several hundred meters. The diversion reach will be dry for dam preparation and construction.

The decline in water and river ecosystem quality, in the Cisokan and Cilenkong Rivers, are affected by the land clearing activities and the construction process of the UCPS lower dam. The results of the analysis of parameters BOD, COD and DO and *E. coli* load, have not met the quality standard. This indicates that Cisokan is already polluted by domestic waste. An increase in contamination and dissolved solids, in the waters of the Cisokan river, can cause an increase in water temperature and a decrease in dissolved oxygen levels, which can be detrimental to the river ecosystem.

The impact assessment on the reduction of water and river ecosystem quality, during the construction stage of the Cisokan river, is shown in Table 51.

Table 51. Impact Assessment of River Habitat and Water Quality of Cisokan River during the Construction Stage

Impact	Decreasing water quality and changing river habitat in the Cisokan river; especially with regard to increased levels of pollutants from domestic waste and suspended solids by domestic waste and erosion of land clearing.				
Impact Nature	Negative	Positive	Neutral		
	The increase in the population of the catchment area (residents and workers) increases domestic waste, which causes an increase in the pollutant load to water bodies.				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	Increasing the number of non-point source pollutants, in the form of domestic waste, increases the pollutant load, especially concerning BOD, COD and *E. coli* load, which will directly reduce the quality of river habitat, which is indicated by an increase in the value of the dominance index (trend analysis)				
Impact Duration	Temporary	Short-term	Long-term	Permanent	

	The increase in environmental pollution load from domestic waste can be temporary or long-term depending on the efforts made, because the reduction of the pollutant load can be done by reducing the amount of pollution that is channelled into the river.				
Impact Extent	Local	Regional	Global		
	The increase in the pollution load to the Cisokan water body will have an impact on decreasing the quality of the river habitat. The resulting impact will be a decrease in the diversity of aquatic biota.				
Impact Magnitude	No change	Slight	Low	Medium	High
	The quality of the aquatic habitat will decrease.				
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
	Changes in water quality will affect the diversity of aquatic biota because there are species that are vulnerable to habitat quality degradation				
Impact Severity	Slight	Low	Medium	High	Very High
	Medium impact magnitude, and low-medium receptor sensitivity, resulted in medium impact severity.				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood/Inevitable
	Decreasing water quality will generally occur in construction activities in river bodies, which are a hydrological unit				
Significance	Negligible	Minor	Moderate	Major	Critical
	Impact severity medium, with likelihood medium resulted, in Minor-Moderate significance				

10.2.2.6 Water quality in Cirumamis River

Cirumamis River is the main water source for the upper dam of the UCPS. The quality of water and river ecosystems of the Cirumamis river was affected by the land clearing activity and the dam construction process on UCPS. The Cirumamis catchment area is predominantly vegetated land, so the parameters regarding domestic waste before construction are lower, however, with construction activities involving a number of workers, it will certainly increase the contamination of water bodies by domestic waste. The impact assessment on the reduction of water quality and river habitat during the construction stage of the Cirumamis river is shown in Table 52.

Table 52. Impact Assessment of River Habitat and Water Quality of Cirumamis River during the Construction Stage

Impact	Decreasing water quality and river habitat in the Cirumamis river				
Impact Nature	Negative	Positive	Neutral		
	Construction activities in the area is expected to increase domestic waste to water bodies, thereby reducing water quality and respective habitat for aquatic biota				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	Contamination from domestic waste will increase the content of BOD, COD and decrease DO which has an impact on decreasing the habitat of aquatic biota.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	Contamination occurs when waste directly flows into the Cirumamis.				
Impact Extent	Local	Regional	Global		
	Pollution occurs in Cirumamis water bodies which can flow downstream				
Impact Magnitude	No change	Slight	Low	Medium	High

	Decreasing water quality can cause a decrease in biota and biodiversity				
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
	Decreasing water quality in Cirumamis water bodies will impact aquatic biota that are vulnerable to changes in water quality, as well as insects that use water bodies in larval and reproductive stages of their life cycle.				
Impact Severity	Slight	Low	Medium	High	Very High
	Impact magnitude medium, and receptor sensitivity low-medium, resulted in impact severity medium.				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood/Inevitable
	A decrease in water quality will occur even though the dynamics of water quality are strongly influenced by the activity of pollutant sources and the amount of water flowing downstream and have an influence on the concentration value.				
Significance	Negligible	Minor	Moderate	Major	Critical
	The impact severity of medium, with medium likelihood, resulted in minor-moderate significance				

10.2.2.7 Water quality in Cirendeu River

Based on the 2011 UCPS Andal document for access road, quarry, and fly ash utilization, the calculation of rock crushing in the quarry of Gunung Karang is 11.66 tons of material. By taking into account the affected Cireundeu river area of 1,875 m^2, at a depth of 2.5 meters, during the construction period of 4 years, it has the potential to increase the total suspended solids (TSS) concentration by 248.7 mg/L (PLN, 2007). Cirendeu River flows into the Saguling Reservoir.

The potential for an increase in Total Suspended Solids of 248.7 mg/L is still below the quality standard stated in Government Regulation Number 82 of 2001 concerning Water Quality Management and Water Pollution Control, which is 400 mg/L. The impact assessment on the decline in water quality in the Cireundeu river as a result of mining and processing of andesite rock is shown in Table 53.

Table 53. Impact Assessment of River Habitat and Water Quality of Cirendeu River during the Construction Stage

Impact	Decreasing water quality and river habitat in the Cirendeu River				
Impact Nature	Negative	Positive	Neutral		
	The material mining activity requires the destruction of the land causing waste to enter the drainage channel leading to Cirendeu.				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	Waste in the form of dust from mining activities, including land clearing and material breakdown, can be transported by the drainage channel and flow to Cirendeu, causing an increase in TSS content.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	Total Suspended Solids contamination will have a direct impact on water bodies by increasing turbidity and, if the transport force decreases, sedimentation.				
Impact Extent	Local	Regional	Global		
	Decreased water quality and sedimentation of the river will occur for several hundred meters or to the next significant tributary, without mitigation.				
Impact Magnitude	No change	Slight	Low	Medium	High

	The impact of declining water quality due to quarry water drainage will increase the TSS but this is not expected to exceed the national quality standard				
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
	Water and biodiversity are objects / receptors that will be affected. They are already impacted by sedimentation, pollution from untreated wastewater and habitat disturbances.				
Impact Severity	Slight	Low	Medium	High	Very High
	Impact magnitude medium and receptor sensitivity low-medium results in impact severity medium.				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood/Inevitable
	The dynamics of water quality are largely determined by the dynamics of polluting sources; the risk of impact on water bodies is in a medium position.				
Significance	Negligible	Minor	Moderate	Major	Critical
	The impact severity of medium, with medium likelihood, was of minor-moderate significance				

The results of the impact assessment on habitat and water quality in the Cisokan, Cirumamis, and Cirendeu rivers showed minor-moderate impact significance. Based on these results, the impacts that arise can be reduced by implementing mitigation measures and water quality monitoring during activities in the Gunung Karang quarry. Details of the mitigation that must be done to reduce these impacts are discussed in Chapter 13 regarding the environmental and social management plan.

10.2.3 Aquatic biota

Various construction activities disturb aquatic biota, as well as reduce primary production and the ability of basic animals to forage. The flow of contaminants into river bodies causes a decrease in fish breeding habitat and adversely affects the ability of fish eggs to reach the adult stage. Changes in sediment input with high organic material can reduce dissolved oxygen, resulting in fish/invertebrate mortality. Construction also causes changes in the dimensions of the river flow, so that rocks and niches that were previously used for shelter contain sediment. Covering rock faces reduces habitat for invertebrates. This changes the number and types of existing invertebrate species from sensitive species to more tolerant species such as snails, which can lead to changes in fish populations, due to decreasing food sources.

The construction stage may lead to a decrease in water quality which could cause significant disruption of river habitats, especially for fish. RKL RPL data, until 2019, shows that there has been a decrease in the number of fish sightings, especially in 2015-2016, which was the initial period of construction. Causality between project development and these trends are, however, not clear because most developments have been around the access road which should not have impacted rivers. Increased fishing pressure, sampling issues, or other factors may have resulted in changes in fish numbers.

Based on baseline information for the rivers potentially affected by the project, such as the Cirendeu, Cijambu, Cirumamis, Cilengkong and Cisokan there are still 10-15 fish species present; 17 river-species including turtles and shrimp. Species monitoring in the Cirendeu River recorded 12 fish species, while 14 fish species were recorded in the Cisokan. The Hampala species (*Hampala macrolepidota*), which was recorded in the 2009, was not observed in monitoring from 2009-2019. These results are strengthened by limited communication from sources who work as fishermen in the Cisokan River who catch the Hampala species 5-6 times a week. These findings were mostly found in the Cirumamis River, as several informants who had caught fish in the river found Hampala species 6-7 times a week.

The findings of the hampala fish indicate that the conditions of the rivers in the project area, especially the upstream areas, still have good ecosystem integrity. The data concerning plankton between 1,410-1,830 ind./L shows that the upstream sections of the Cijambu, Cilengkong, Cirumamis and Cisokan Tivers are categorized as oligotrophic, which means they are still clean and have not been polluted with nutrients. Meanwhile, the Cirumamis and Cisokan Rivers' lower sections found 2,610-4,140 ind/L plankton, which indicates a mesotrophic environment or one that has been moderately polluted, generally by anthropogenic activities in the downstream area.

Fish migration in this river system has already been affected by two existing dams located downstream of the Cisokan river, which have blocked off the upper course to sea connections for several decades. The Cisokan River is a tributary of the Citarum River which empties into the Java Sea. Currently, there are 3 dams in the Citarum River; in order from downstream to upstream, Jatiluhur (1967), Cirata (1987) and Saguling (1985). The diversity of native fish species in the Citarum River has decreased drastically. Of the 34 fish species native to the Upper Citarum River, Kaskade Reservoir and Citarum Hilir, only 26 types of fish remain and as many as eight species which are economically important fish have not been caught in recent years (Kartamihardja, 2019). The diversity of caught fish species is dominated by introduced and invasive fish. Pollution, damming rivers, changing aquatic habitats and over-exploitation are the main causes of degradation of the native fish diversity. Recovery of fish resources is essential and can be carried out with the aim of improving fish populations. Efforts to restore fish resources can be carried out in various ways and options, namely habitat rehabilitation, restocking and development of fish hatcheries and development of environmentally friendly capture fisheries (Kartamihardja, 2019).

Under these conditions, the risk of disruption to fish migration from downstream to upstream is likely to be small. In addition, the potential for disruption to fish life in the downstream area is also negligible, as the majority of species migrate locally, have the ability to adapt with high resistance to habitat changes, and are not protected either nationally or internationally. Based on this, the construction of the dams in the Cisokan and Ciromanis Rivers has no impact on catadromous and anadromous species in UCPS.

In conclusion, the aquatic system contains mostly native species and human activity has not essentially modified the rivers' primary ecological functions and species composition, although unsustainable fishing has diminished populations and possibly resulted in the local extinction of one species, *Hampala macrolepidota*.

The natural habitat will be significantly altered by project development, changing from a rapidly-flowing river to a more lacustrine environment, which will require appropriate implementation of the mitigation hierarchy. The area of direct impacts on the aquatic system spatially overlaps with the area of direct impacts on the terrestrial system and consists mostly of the 340 ha of inundated areas on the two reservoirs.

10.2.4 Groundwater

The results of the identification of groundwater resources, through measurements of changes in well depth, indicate that there has been a small, fluctuating increase in well depth, therefore, it can be stated that the well depth is relatively stable. The identification results show that the study location is not an area of the Groundwater Basin, so that the construction of UCPS will not have an impact on groundwater sources, according to the Minister of Energy and Mineral Resources No.2 of 2017, which states that regional development needs to consider the Groundwater Basin as a groundwater aquifer area. The projected increase in workers at the construction stage, however, does require good management of water resources.

10.2.5 Air Quality

Air quality may be affected in the form of dust, particulate matter and gas emissions from exhausts. Dust mainly comes from the use of roads, cleared land and riverbeds in the work area and during reservoir cleaning, material stockpiling, quarry operations, stone grinding, blasting in quarries and work sites, and cement manufacturing sites. Particulates (other than dust) and gas are emitted from vehicles, heavy machinery, diesel generators and asphalt processing sites.

The impact of air contaminants, such as dust, can disrupt local communities (deposition in water supplies and on buildings and other facilities), while it can also affect public health. The communities most at risk are those close to the main access road or quarry, because these locations are most exposed to dust and vehicle emissions.

The main mitigation measures are covered by the Environmental Management Plan and associated sub-plans and include the management of dust, exposed soil and material emissions; maintenance of vehicles and equipment to control emissions; avoid burning vegetation and trash; and managing a complaint and resolution service system. The dust impact is less severe with the normally weak wind occurring at the project site.

10.2.5.1 Air Quality around Quarry

Based on the impact forecast in the ANDAL 2011 document (PLN, 2011b), the distribution of the impact of the resulting dust is estimated through an approach based on Stoke's law for the deposition of particles in the fluid. Assuming that the average diameter of the dust is 50-100 µm, the particle terminal velocity value is 0.077-0.309 m/s. If the dust level at the activity location reaches 50 m, the time needed for dust to reach the ground is around 162 - 647 seconds or 0.05 - 0.2 hours. With an average wind speed at the activity location of 2.1 m/s, the distribution distance is 404 - 1,618 m. Based on RKL-RPL monitoring results, the dominant wind direction in the quarry is to the west and east. The nearest settlement is ± 400 m from the center point of the quarry site. The denser residential areas are located to the east and northeast of the quarry site. An assessment of the potential impact on air quality at the Gunung Karang quarry is shown in Table 54.

Table 54. Air Quality Impact Assessment on Gunung Karang Quarry

Impact	The decline in air quality is due to rock mining activities in the Gunung Karang quarry				
Impact Nature	Negative	Positive	Neutral		
	The impact of the process of mining, transporting and processing stone will cause dust that can fly into the air and cause air disturbance, especially when demolition is carried out.				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	The dust from stone mining and crushing can be scattered into the air and the surrounding environment.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	

	The dust produced by the mining and stone processing activities is relatively small, so after the work time the dust falls back down.				
Impact Extent	Local	Regional	Global		
	The resulting impact area depends on wind speed and wind direction, but the average wind speed is not too large, so the potential area affected is only local				
Magnitude	No change	Slight	Low	Medium	High
	With an average wind speed at the activity site of 2.1 m/s, the distribution distance is 404 - 1,618 m from the center point of the Gunung Karang quarry.				
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
	The air around the activity can contain dust particles that float in the air, so that it can disturb workers or the surrounding community, especially in a radius of less than 1 km.				
Impact Severity	Slight	Low	Medium	High	Very High
	Impact magnitude medium and receptor sensitivity medium resulted in impact severity high.				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood/Inevitable
	Particulate waste pollution into the air is caused by mining activities, the intensity of mining will greatly affect the impacts that arise.				
Significance	Negligible	Minor	Moderate	Major	Critical
	The high impact severity, with medium likelihood, results in a Major Significance level				

10.2.5.2 Air quality around access Road

The activity of transporting material from the Gunung Karang quarry to the main construction site is estimated to reduce air quality due to the emission of heavy vehicle exhaust gases. The exhaust gas composition of diesel engine drive equipment is shown in Table 54.

Table 55. Concentration of Diesel Engine Exhaust Gas

Component	Unit	Value
CO	Ppm	0.49
NO_x	µg/m3	280
SO_x	µg/m3	11
Hydrocarbon	µg/m3	60

Determination of the amount of exhaust emissions generated by heavy vehicles is calculated using the basis of emissions generated by trucks. Transportation during the operation phase is estimated to be carried out by 30 trucks per day. Emission coefficients for trucks from the Department of Transportation (West Java) are:

- CO = 2.51 g/km,
- SO_2 = 16.1 g/km,
- NO_x = 1.28 g/km,
- HC = 2.37 g/km
- Dust = 0.54 g/km

Based on the emission coefficient and traffic density mentioned above, the amount of emissions by transport vehicles, for each air quality parameter, is as follows:

- CO = 0.1506 kg/day/km = 0.029 µg/m-sec
- SO_2 = 0.966 kg/day/km = 0.186 µg/m-sec
- NO_x = 0.0768 kg/day/km = 0.015 µg/m-sec
- HC = 0.1422 kg/day/km = 0.027 µg/m-sec
- Dust = 0.0324 kg/day/km = 0.006 µg/m-sec
- Pb = < 0.65 µg/Nm

The analysis results in the UCPS ANDAL document, 2011 (PLN, 2011b) using a modified Gauss dispersion equation for the finite length line source, at a dominant wind speed of 2.1 m/s perpendicular to the road orientation, the maximum concentration is estimated to occur at distance of 10-20 m. The addition of pollutant concentrations due to vehicles transporting equipment and materials is shown in Figure 99.

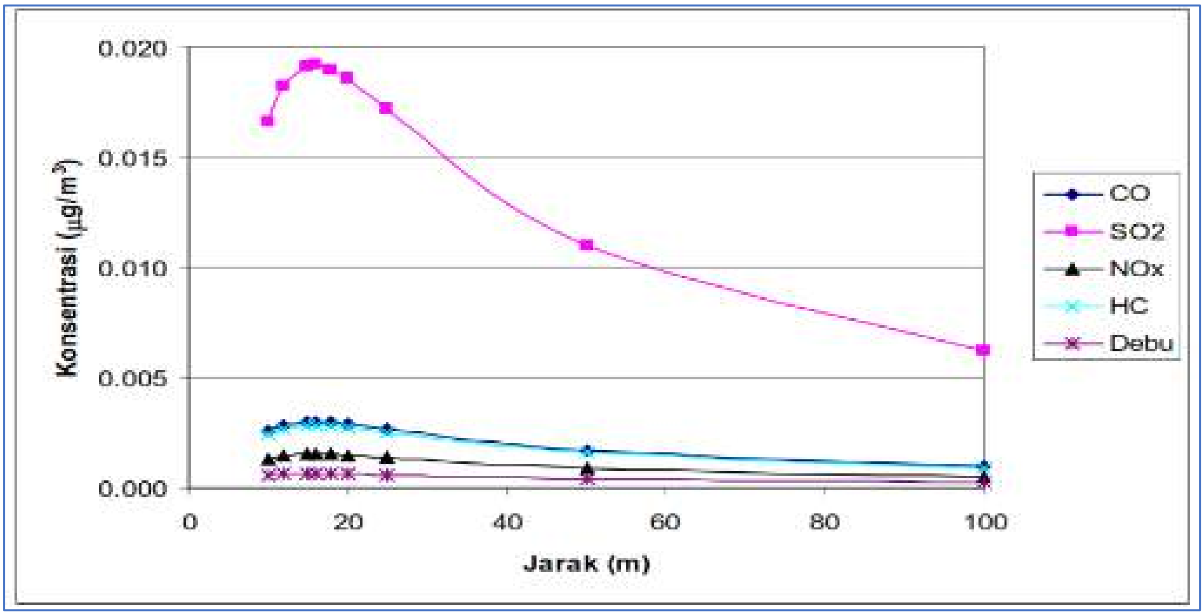

Figure 99. Decreasing Concentration of Air Pollution Due to Exhaust Gas Emissions for Vehicles Transporting Equipment and Materials with increasing distance from the Transport Road

The results of this calculation indicate that the contribution of motor vehicle exhaust emissions to air quality degradation in material mobilization activities is small, with an average pollutant concentration <1% of the air quality baseline environmental data and below the ambient air quality standard in accordance with Government Regulation No. 41 year 1999.

An assessment of the potential impact on air quality degradation along the access road from the quarry to the main construction site is shown in Table 56.

Table 56. Air Quality Impact Assessment on Access Road during the Construction Stage

Impact	Decreased air quality due to using access road for transporting heavy equipment to andesite mining location				
Impact Nature	Negative	Positive	Neutral		
	Transportation of heavy equipment and materials for construction will increase dust discharge into the air				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	Transporting machinery, hauling material, and fly ash will provide direct air-to-air debris scattering along the road				

Impact Duration	Temporary	Short-term	Long-term	Permanent	
	Dust scattering around the main road occurs during transportation in construction activities				
Impact Extent	Local	Regional	Global		
	Air pollutant scattering, when at maximum concentration, will impact the corridor of 10-20 meters on either side of the main road.				
Impact Magnitude	No change	Slight	Low	Medium	High
	The contribution of motor vehicle exhaust emissions to air quality degradation in material mobilization activities is small, with an average pollutant concentration <1% of the air quality environmental baseline data.				
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
	The impacts that are caused around the main road or corridor of the main road will disrupt the premises and activities of residents who are less than 100 meters from the main road. Along the 27 km of access road, densely populated settlements are only found in approximately 6-7 km between the Cipari quarry – at the T-junction.				
Impact Severity	Slight	Low	Medium	High	Very High
	Impact magnitude low and receptor sensitivity low-medium resulted in impact severity low.				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood/Inevitable
	Based on the project description, construction will last for 4 years so that the impact likelihood is of medium likelihood.				
Significance	Negligible	Minor	Moderate	Major	Critical
	The impact severity of medium, with medium likelihood, was of minor-moderate significance				

10.2.5.3 Air Quality Around Main Construction Sites

Construction activities have an impact on air quality at the site and its surroundings. A decrease in air quality can be seen from the increase in several key parameters such as dust, NO_x, SO_x, and CO. The increase in dust levels at the main building construction site (upper and lower dam) comes from rock particles bursting from rock blasting activities for powerhouse structures, penstock and headrace tunnels, bending body construction activities, and mobility of the tools and machines used. Meanwhile, increased levels of NO_x, SO_x, and CO resulted from the operation of the tools, machines and transportation vehicles used during construction activities. The spread of air quality impact particulates is influenced by wind speed and direction around the construction site. The dominant wind direction at the UCPS main building construction site is to the West and East, with speeds ranging from 0.2 to 3.52 m/sec. The location around the construction site does not have many settlements, only a few villages with a moderate population density. The settlement closest to the construction site is the Lembur Sawah village, with a distance of less than 1 km. The impact of decreasing air quality will last for the duration of the UCPS construction process, which is between 3.5—4 years.

An assessment of the potential impact on air quality degradation at the main building construction sites is shown in Table 57.

Table 57. Air Quality Impact Assessment at Main Construction Sites during the Construction Stage

Impact	The decline in air quality is due to the activities of the construction of the upper weir, the lower weir, and other supporting facilities.				
Impact Nature	Negative	Positive	Neutral		
	Deterioration of air quality during the construction of the weir can threaten the smooth running of activities of workers and the surrounding community.				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	Deteriorating air quality is a direct result of the UCPS construction activities and the operation of heavy equipment, machinery and vehicles.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	Deterioration in air quality, due to scattering of dust into the air, will occur for the duration of construction activities., about 3.5 - 4 years.				
Impact Extent	Local	Regional	Global		
	The scattered dust particles have a fairly heavy weight, meaning that deposition is local				
Impact Magnitude	No change	Slight	Low	Medium	High
	The magnitude of the impact of air pollution is strongly influenced by the construction activity unit and the number of tools, machines and vehicles used. The dust particulate distribution is unlikely to spread far from the activity location because the construction site is in a valley area so that the air distribution will be obstructed by the surrounding cliffs and hills.				
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
	Decreasing air quality, especially due to dust, can interfere with human activities around the site. The impact felt by workers tends to be smaller because they have used personal protective equipment, while the surrounding community will be quite sensitive.				
Impact Severity	Slight	Low	Medium	High	Very High
	Impact magnitude medium and receptor sensitivity low-medium resulted in impact severity medium.				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood/Inevitable
	A decrease in air quality around construction activities will likely occur				
Significance	Negligible	Minor	Moderate	Major	Critical
	The impact severity of medium, with medium likelihood, was of minor-moderate significance				

The results of the impact assessment on air quality, due to construction activities for the Gunung Karang quarry location, resulted in a major significance of impact, meaning that special mitigation was needed to minimize the impact that occurred. Meanwhile, the main access roads and construction sites had a minor-moderate impact significance. Mitigation to reduce the risk of negative impacts from reducing air quality is described in Chapter 12 on environmental management plans.

10.2.6 Noise

The evaluation of the noise impact of construction activities at UCPS is analyzed based on the location and type of work carried out, the distance of the receptors from the noise, the source of noise from tools, machines and vehicles used, and the potential noise levels that will occur.

The UCPS project noise sources consist of; quarrying, land clearances, earthworks, construction of dam bodies, construction of underground generating facilities, construction of tunnels, and vehicle movements along the access roads. The noise source data is based on the 2011 UCPS AMDAL document (PLN, 2011b). The noise dispersion has been done with the attenuation during propagation outdoors modelling based on ISO 9613-2 (Figure 100). The attenuation includes ground effect, hill barrier/wall, housing and foliage around the UCPS area.

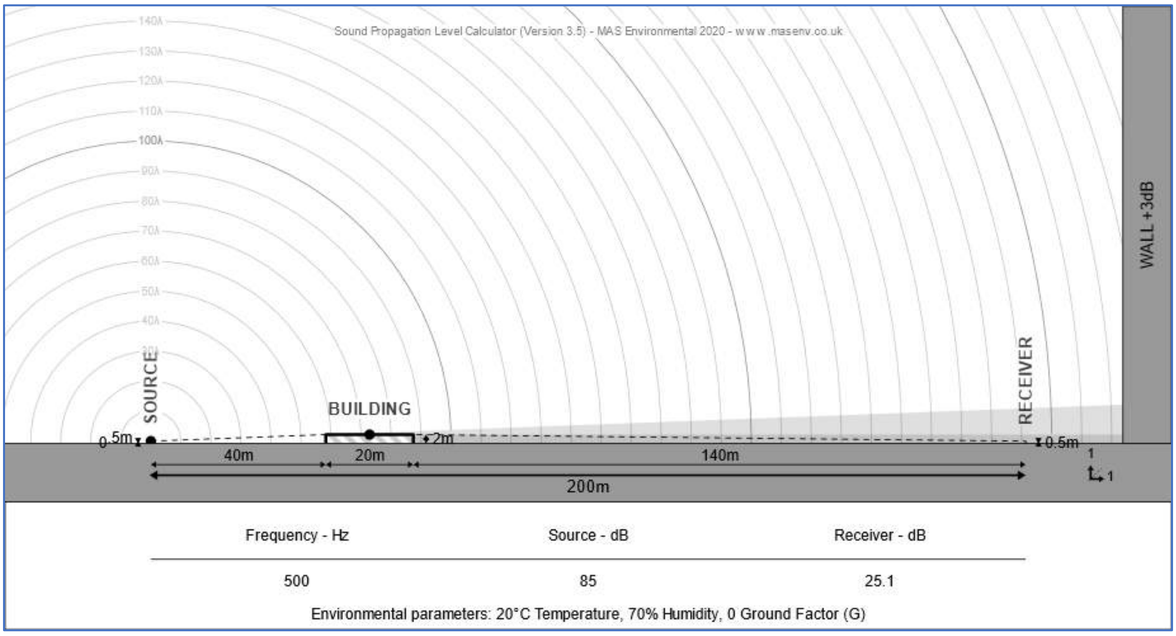

Figure 100. Noise Modelling Based on ISO 9613-2

10.2.6.1 Noise Impact from Quarry

Noise in the Gunung Karang quarry area results from quarrying activities including drilling, blasting, crushing and transportation of mining materials, which reduce with distance from the quarry (Figure 101).

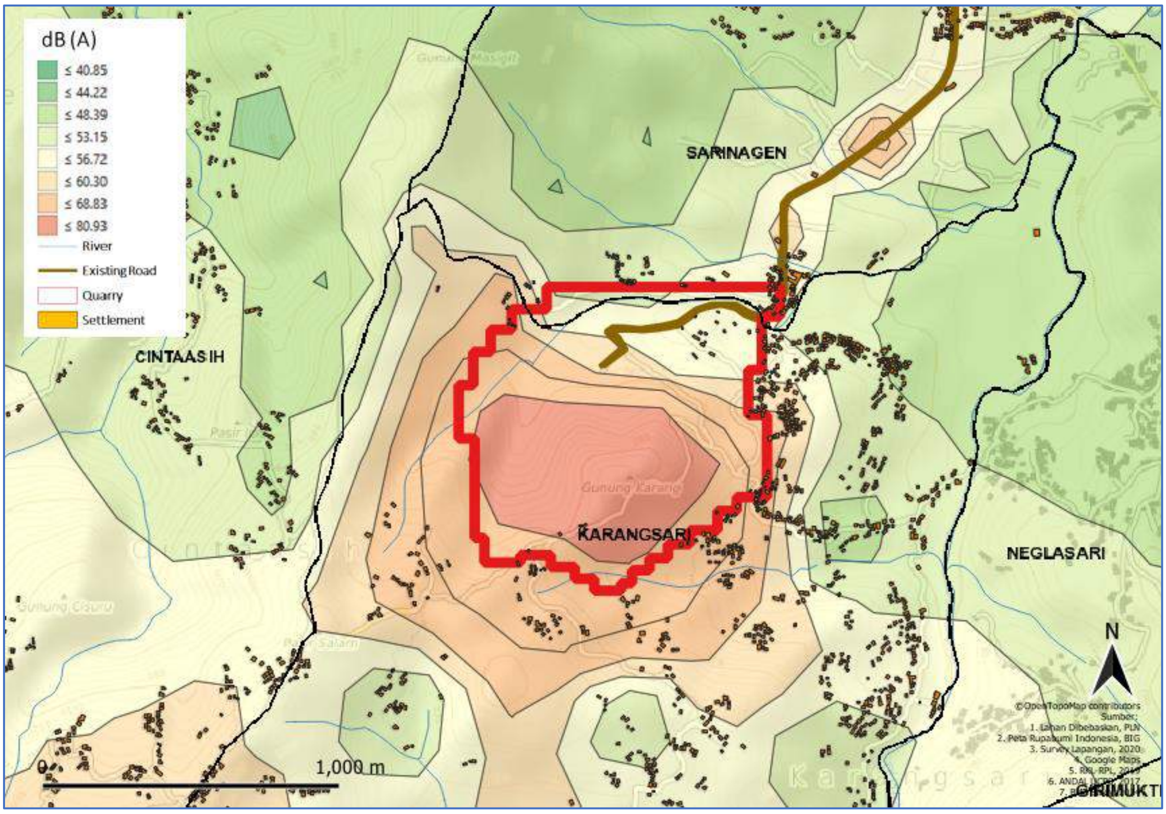

Figure 101. Noise Dispersion Prediction in Quarry Gunung Karang

The mined stone material will be transported using a dump truck. Based on the 2011 UCPS AMDAL document (PLN, 2011b), mining will be assisted by blasting activities using explosives in accordance with the characteristics of the rock. The blasting system will use an electronic detonator and the use of a delay system. The explosive used was ANFO (Ammonium Nitrate Fuel Oil). Based on the 2011 UCPS AMDAL document, it is known that the noise level in residential areas due to the use of heavy equipment in activities at the quarry location is 68 dBA.

The intensity of the noise is above the quality standard for the residential noise level of 55 dBA, meaning it has the potential to disturb the community, especially in Karangsari and Sarinagen villages. The assessment of the impact of increased noise at the Gunung Karang quarry location is shown in Table 58.

Table 58. Noise Impact Assessment on Gunung Karang Quarry during Construction Stage

Impact	Increased noise at the Gunung Karang quarry location due to mining, crushing and use of heavy vehicles.				
Impact Nature	Negative	Positive	Neutral		
	Explosions and activities at the Gunung Karang mine will disturb the comfort of local residents.				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	An increase in noise is a direct impact that has the potential to cause discomfort to residents, especially in the form of increased stress, hearing loss and disturbances in activities that require quiet.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	The noise increase is short-term because it only lasts for 3.5 - 4 years.				

Impact Extent	Local	Regional	Global		
	Noise is influenced by the distance to the center of the noise in addition to the sound intensity, so the disturbance is local according to the distance from the location to the sound source.				
Impact Magnitude	No change	Slight	Low	Medium	High
	The noise intensity, received by the receptors in the settlements around the quarry location, is 68 dBA.				
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
	The impact caused by noise is quite large, especially for people who have high sensitivity, such as the villagers of Karangsari. The intensity of the noise will greatly interfere with activities.				
Impact Severity	Slight	Low	Medium	High	Very High
	Impact magnitude medium and receptor sensitivity medium resulted in impact severity high.				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood/Inevitable
	The increase in noise due to mining activities and heavy equipment operations is a definite impact				
Significance	Negligible	Minor	Moderate	Major	Critical
	The impact severity of medium, with medium likelihood, resulted in Major Significance				

10.2.6.2 Noise Impact from Access Road

Based on the results of theoretical calculations, the operation of a motor vehicle/truck that transports materials will contribute to a noise increase of ± 70 dBA. The estimated noise in a residential area within ± 10 m from the main road through calculations with a single point spread is as follows:

$$Ts1-Ts2 = 10 \log r2/r1$$

The results of the estimated magnitude of noise impact at each distance from the main road are shown in Table 59.

Table 59. Amount of Noise Level at Varying Distances from Access Road

Distance (m)	Noise (dBA)
10	60
30	55,2
50	53,01
100	50
200	46,9

The calculation shows that the noise level, caused by the activity of mobilizing vehicles in residential areas with a distance of more than 50 m from the main road, is still below the standard noise level for residential areas of 55 dBA. Meanwhile, at a distance of less than 30 meters it is above the quality standard.

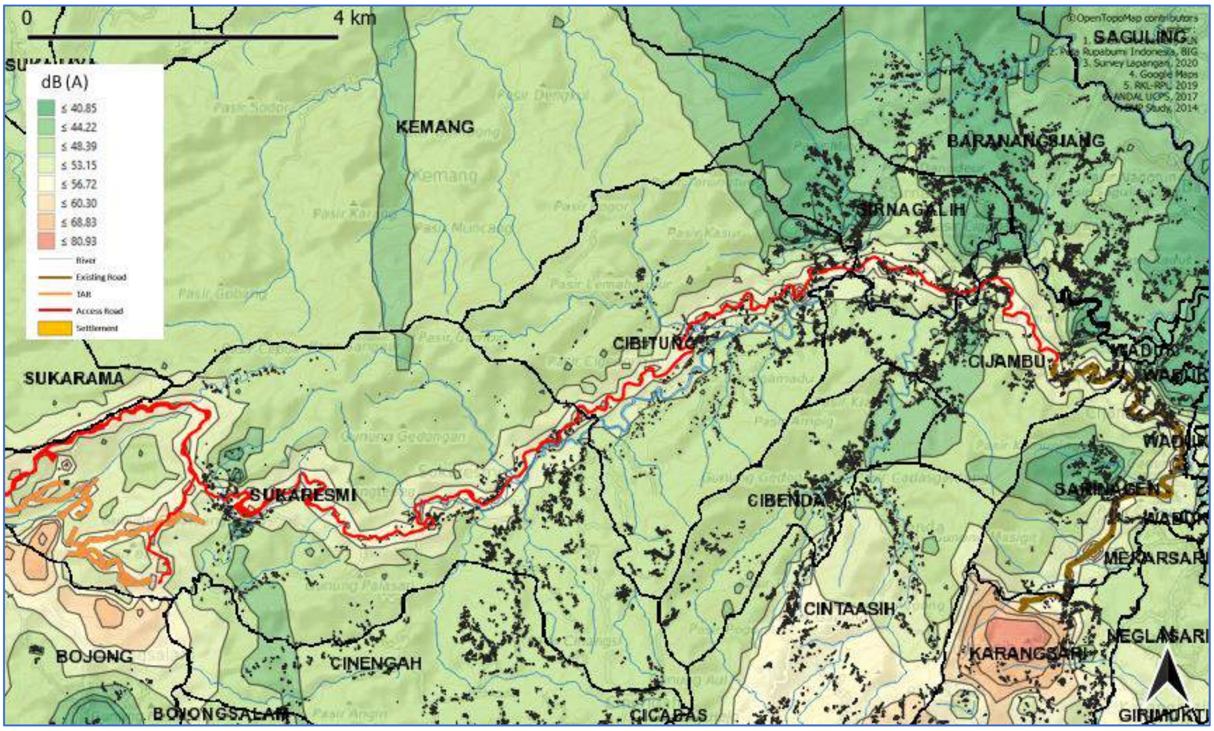

Figure 102. Noise Dispersion Prediction in Access Road

Sensitive receptors that are potentially affected are residential areas along the access road between the quarry-Cipari junction (Figure 102). The access road will be traversed by heavy trucks carrying rocks from the quarry to the upper and lower dams. The distance between the settlement and the road is less than 50 meters, so it is in the low-medium category. The impact severity and likelihood of noise are included in the medium category.

The impact assessment of increased noise along the access road is shown in Table 60.

Table 60. Noise Impact Assessment on Access Road during the Construction Stage

Impact	Increased noise along the access road from the quarry to the main construction site				
Impact Nature	Negative	Positive	Neutral		
	Transportation of materials and mobility of heavy equipment on the main road will cause an increase in sound intensity which can disturb the comfort of the surrounding community.				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	The increase in noise is a direct result of the operation of trucks transporting materials from the quarry to the main construction site				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	The increase in noise occurs when the hours of construction activities increase due to the movement of material and heavy equipment transportation from the Gunung Karang quarry location to the main construction site. Noise will decrease along with reduced mobilization, so the duration is a short-term impact.				
Impact Extent	Local	Regional	Global		
	The effect of noise caused by activities on the access road will only be felt by settlements along the main road within a radius of less than 100 meters.				
Impact Magnitude	No change	Slight	Low	Medium	High

	The amount of noise generated from the activity of mobilizing vehicles along the main road is 76 dBA. The noise level is reduced to 50 dBA at a distance of 100 meters from the noise source.				
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
	The densely populated settlements along the main road between the quarry and the Cipari junction have a high sensitivity because the settlement distance is less than 30 m, so the noise level received is still above 50 dBA. Settlements from Cipari junction to the construction site have little sensitivity because the settlements are relatively far from the main road.				
Impact Severity	Slight	Low	Medium	High	Very High
	Impact magnitude low and receptor sensitivity medium-high resulted in impact severity medium.				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood/Inevitable
	An increase in noise due to the activity of vehicles/trucks will occur in every construction project activity.				
Significance	Negligible	Minor	Moderate	Major	Critical
	The impact severity of medium, with medium likelihood, resulted in Moderate Significance				

10.2.6.3 Noise Impact from Main Construction Site

The impact of rock blasting for the powerhouse, penstock and headrace tunnel structures is noise around the activity site. The predicted noise level during detonation can reach 84 dB (A) at a distance of less than 50 meters. The estimated noise in a residential area more than 50 m from the main road, by means of a one-point distribution calculation is as follows: $Ts1-Ts2 = 10 \log r2/r1$

The results of the estimated magnitude of the noise impact at each distance from the main construction activity location are shown in Figure 103.

The increase in ambient air noise will take place at the activity location, especially at the beginning of tunneling because it is carried out on the outer surface of the rock. Meanwhile, in the next stage, the blasting will be carried out in a tunnel so that the noise does not disturb residents who live about 1 km from the location of the activity (Lembur Sawah Village). The impact felt by workers is relatively small because they will be equipped with personal protection equipment.

The increase in noise due to construction activities has a negative impact, especially for human and animal receptors. The impact of noise is direct during the activity. The duration of the impact is only about 3.5—4 years. The noise level, resulting from UCPS construction activities is local in nature, and only affects areas near the construction site. The magnitude of the impact of the noise will decrease as the distance of the receptors gets further. The intensity of the impact will be continuous as long as the supporting machine construction activities take place.

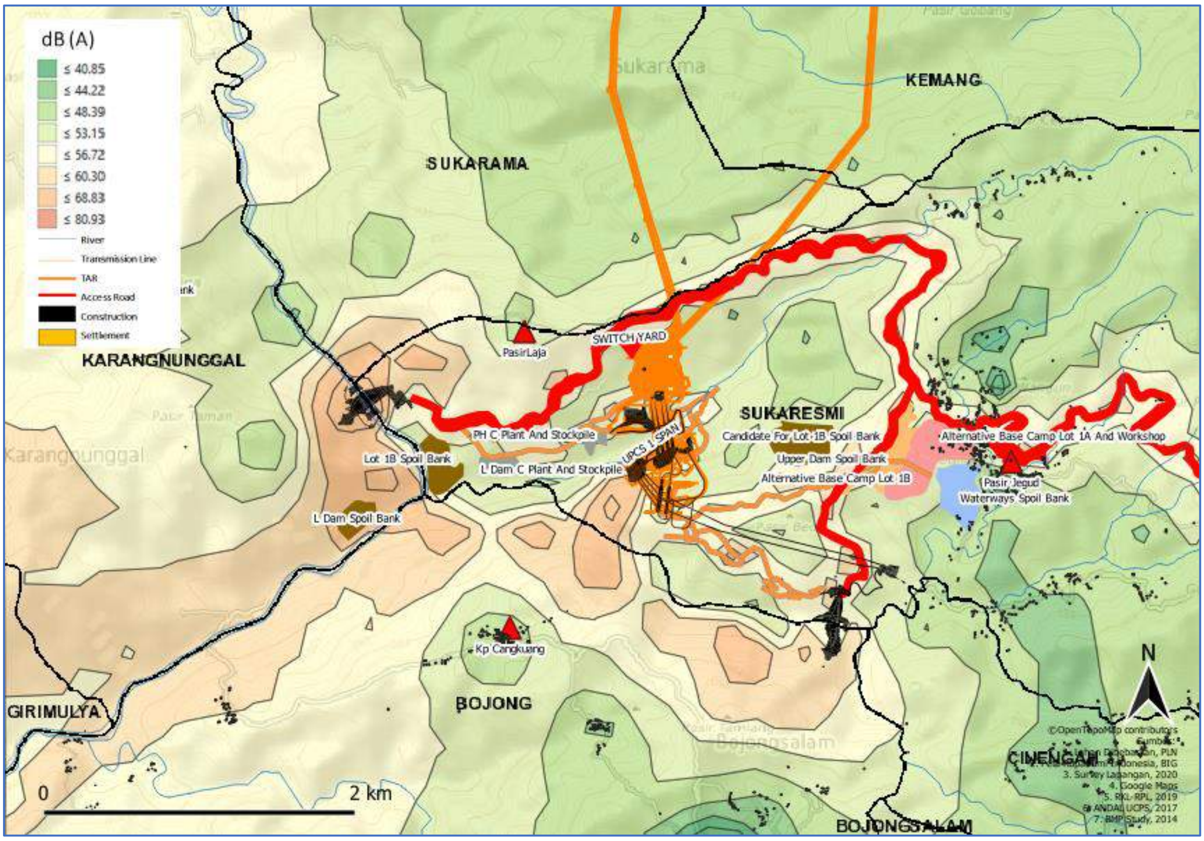

Figure 103. Noise Dispersion Prediction around the Main Construction Site

The impact assessment of increased noise at major construction sites is shown in Table 61.

Table 61. Noise Impact Assessment at Main Construction Sites during the Construction Stage

Impact	Increased noise levels due to activities in the construction of the upper weir, the lower weir, and other supporting facilities.				
Impact Nature	Negative	Positive	Neutral		
	Noise at construction sites is a hotspot for UCPS activity which causes noise problems that can interfere with receptors such as humans and animals.				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	Increased noise is a direct result of operating tools, machinery and heavy vehicles at major construction sites.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	It is estimated that construction activities will last for 3.5 - 4 years. The increase in noise occurs during the hours of construction activities and will decrease with the reduction in activities, so that the duration is a short-term impact.				
Impact Extent	Local	Regional	Global		
	The noise effect caused by the main construction activities is local in nature because, based on the calculation of the noise level, which is still above the quality standard, it is at a radius of 500 meters. At more than 500 meters, the noise level is below the quality standard for settlements.				
Impact Magnitude	No change	Slight	Low	Medium	High
	The amount of noise generated from the main construction activities is 84 dBA. The noise level is reduced to 57 dBA at a distance of 500 meters from the noise source, and 54 dBA at a distance of 1000 meters (below the quality standard for settlements).				

Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
	In general, at the main UCPS construction site there are not many residents living in the area. However, there are settlements located close to the construction sites, namely Lembur Sawah and Pasirlaja hamlets. Of concern is that the main construction site is located close to animal habitats which may be disturbed by increased noise. So that the receptor sensitivity is of medium-high value				
Impact Severity	Slight	Low	Medium	High	Very High
	Impact magnitude low and receptor sensitivity medium-high resulted in impact severity medium.				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood/Inevitable
	An increase in noise, due to the operation of vehicles, tools and machines, will occur in every construction project activity.				
Significance	Negligible	Minor	Moderate	Major	Critical
	The impact severity of medium, with medium likelihood, resulted in Moderate Significance				

10.2.6.4 Noise Impact from Transmission Line

The increase in noise during the construction activities for the high voltage 500kV transmission line resulting from the mobilization of tools and materials, land clearing activities, tower construction activities (erection of tower), and stringing activities. In general, the impact of noise arising from transmission line construction activities is small or negligible. The potential impact of noise that may result from mobilizing tools and materials is due to the use of transport vehicles, however, most of the tower site locations are in areas that are difficult to reach by 4-wheeled vehicles, limiting vehicle use to the outer area and not to the tower site location. Thus, the noise level is small. Likewise, because of access limitations construction activities will be carried out using medium-sized tools and machines so that the resulting noise is not so great. Potential receptors for impact are residents who live on the side of the road which the project vehicles use. The area of the impact distribution is limited to the traffic path of the project vehicles and the transmission line. The impact will be intermittent during construction activities.

The impact assessment of increased noise from transmission line construction activities is shown in Table 62.

Table 62. Noise Impact Assessment on the Transmission Line during the Construction Stage

Impact	The increase in noise levels due to the mobilization of tools and materials in the construction of a 500 kV transmission line tower.				
Impact Nature	Negative	Positive	Neutral		
	Noise during the construction process of tower construction, mobilization of tools and withdrawal of network cables causes an increase in sound disturbances which will have an impact on the comfort of the community.				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	The increase in noise directly occurs when the construction activity reaches the conductor withdrawal activity.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	The duration of the impact lasts during construction activities, but is temporary (not continuous). Construction activities for the 82 towers to be connected are estimated for 1 year.				

Impact Extent	Local	Regional	Global		
	The nature of the disturbance is local only at construction point locations along the transmission line.				
Impact Magnitude	No change	Slight	Low	Medium	High
	The noise generated from transmission tower construction activities is Low.				
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
	Most of the tower site locations are in areas far from settlements so that the sensitivity level to receptors is Low.				
Impact Severity	Slight	Low	Medium	High	Very High
	Impact magnitude low dan receptor sensitivity low resulted in impact severity slight.				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood/Inevitable
	An increase in noise due to the operation of vehicles, tools and machines will generally occur in every construction project activity.				
Significance	Negligible	Minor	Moderate	Major	Critical
	Impact severity Slight with medium likelihood results in negligible significance				

The results of the analysis show that the significant impact of noise at the quarry site is major, on the main road and main construction UCPS site is moderate, and on the transmission, line is negligible. Mitigation efforts specifically need to be applied to the Gunung Karang quarry site to reduce the impact that occurs. Details of the mitigation that must be done to reduce these impacts are discussed in Chapter 12 regarding the environmental and social management plan.

10.2.7 Vibration

The main sources of vibration are heavy vehicles and machinery used to clear land and for the purpose of rock mining and construction, quarry blasting, waterways, lower dams and power house sites, stone mill, cement and asphalt processing sites, diesel generators, and trucks and or other vehicles using the access road and road at the construction site. Although vibrations occur during daytime working hours, vibration emissions from both dam sites will continue at night due to the sustainable nature of the RCC dam construction.

Impact mitigation in the construction area is described in the Environmental Management Plan and its associated sub-plans. Blasting and tunneling activities also traffic on the access road only occur during daytime working hours. Blasting occurs at scheduled times each day, a warning will be issued before blasting can be carried out.

Vibrations will be monitored during construction activities, and the contractor will execute the complaint processing service. The contractor is expected to develop a construction method or schedule for activities that generate noise in accordance with the results of monitoring the vibration level (exceeding the noise standard limit in residential areas) or complaints from the public.

10.2.7.1 Quarry

Increased vibrations in the area around the Gunung Karang quarry were due to andesite mining activities using explosives. The blasting activity in the Gunung Karang quarry, during the construction stage of the dam, will be intensive, meaning that the resulting vibration cannot be avoided. The results of the calculation of the estimated magnitude of the vibration, caused by the blasting process in the Gunung Karang quarry, based on the receptor distance from the 2011 UCPS Hydroelectric Power Plant AMDAL document (PLN, 2011b), are shown in Table 63.

Table 63. Estimated Value of Vibration at Certain Distance Around Gunung Karang Quarry

Blasting Distance	Vibration Magnitude (Maximum PPV)
100 m	57.26 mm/sec
200 m	11.96 mm/sec
300 m	6.25 mm/sec
400 m	3.95 mm/sec
500 m	2.76 mm/sec
1000 m	0.91 mm/sec
2000 m	0.30 mm/sec

The results of modeling the distribution of vibrations resulting from blasting activities in the Gunung Karang quarry for each distance from the vibration source are shown in Figure 104.

The quality standard for the level of vibration due to blasting activities refers to the Indonesian National Standard (SNI 7571: 2010 concerning Blasting Level Standards in Open Mining Activities for Buildings) at the mine site. The standard class II vibration level (buildings with foundations, masonry and cement mortar, including buildings with wooden foundations and mortar floors) is 3 mm/second. Based on calculations, it is known that the vibration level generated from the Gunung Karang quarry blasting process does not surpass the quality standard if the vibration is at a distance of >500 m. It can, therefore, be concluded that buildings with a distance of 500 or more from the Gunung Karang quarry are classified as safe against the impact of blasting vibrations.

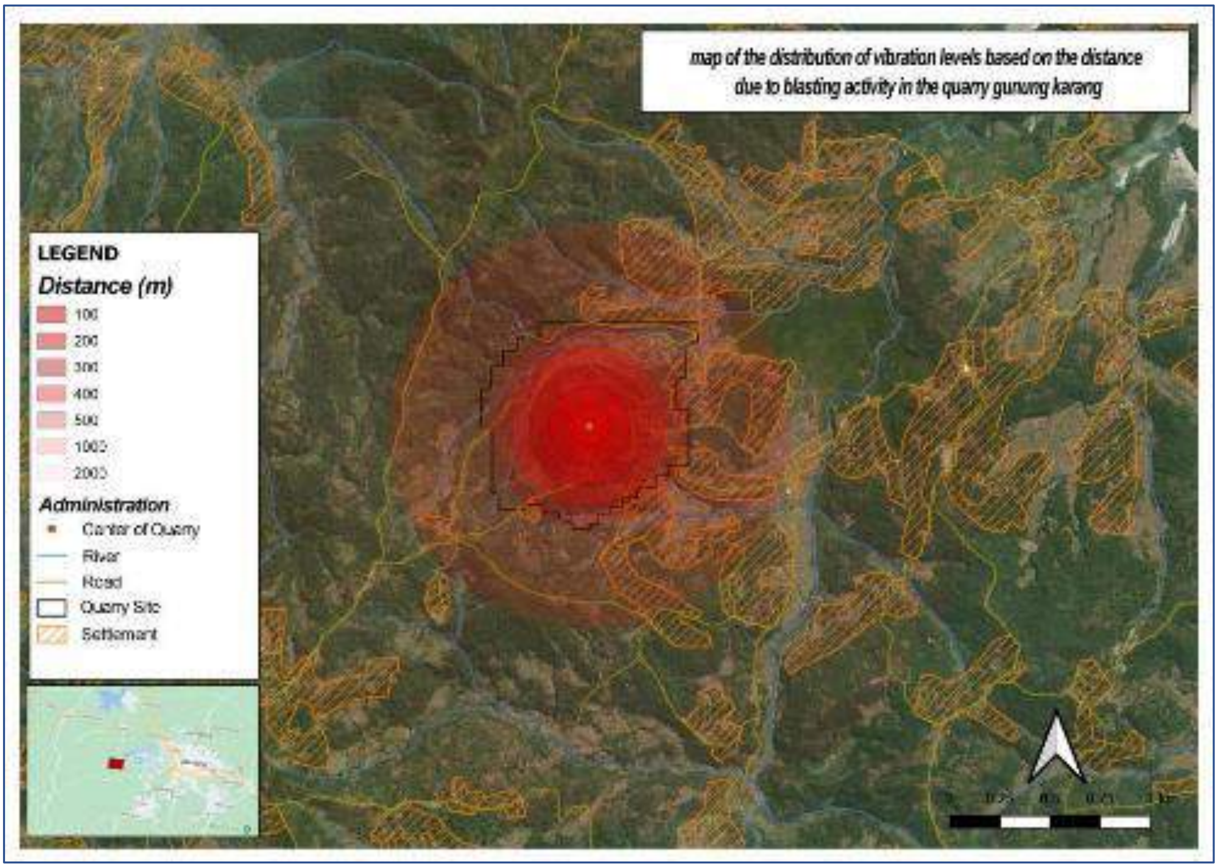

Figure 104. Distribution of Vibration Levels in Quarry Gunung Karang

The assessment of the impact of vibrations at the Gunung Karang quarry is shown in Table 64.

Table 64. Vibration Impact Assessment at Gunung Karang Quarry During Construction Stage

Impact	Increased vibration levels, due to andesite mining activities, include blasting activities, heavy equipment operations and rock processing activities.				
Impact Nature	Negative	Positive	Neutral		
	The vibrations resulting from mining activities in the Gunung Karang quarry are a negative impact that can disrupt the activities of residents, and buildings in the surrounding settlements.				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	Increased vibration is a direct impact of mining activities in the Gunung Karang quarry.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	The impact of the vibration is short-term because it will only be present during mining activities at the Gunung Karang quarry, the duration of the mining activity is 4 years.				
Impact Extent	Local	Regional	Global		
	Based on the calculations, the vibrations have the potential to cause damage to local buildings, but not those more than 500 meters from the vibration site.				
Impact Magnitude	No change	Slight	Low	Medium	High
	Potential vibrations generated from blasting activity in the Gunung Karang quarry at a distance of 100 m = 57.26 mm/sec, 200 m = 11.96 mm/sec, 300 m = 6.25 mm/sec, 400 m = 3.95 mm/sec, 500 m = 2.76 mm/sec, 1 km = 0.91 mm/sec, 2 km = 0.30 mm/sec.				
	Low	Low-Medium	Medium	Medium-High	High

Receptor Sensitivity	Blasting activity is an activity that has a medium-high receptor sensitivity. This is because, around the Gunung Karang quarry, there are settlements less than 1 km away, meaning vibrations can interfere with human activities and safety, and affect the integrity of the buildings in the settlement.				
Impact Severity	Slight	Low	Medium	High	Very High
	Impact magnitude medium and receptor sensitivity medium-high resulted in impact severity high.				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood/Inevitable
	Vibration impacts due to blasting activities will generally occur in open pit mining activities. However, the blasting system is carried out using an electronic detonator and the use of a delay system is expected to reduce the impact of the vibration that appears.				
Significance	Negligible	Minor	Moderate	Major	Critical
	The impact severity of high, with medium likelihood, resulted in Major Significance				

10.2.7.2 Access Road

Vibration along the access road is mainly caused by the movement of the dump truck carrying stones from between the Gunung Karang quarry and the dam construction site. The volume of vehicles transporting construction materials along the delivery road is estimated at 16 rotations/hr or 182 rotations/day. The estimated material to be transported is 1,571,000 tons or 2,133,808 m^3, which is transported using a dump truck vehicle that has a capacity of 20 tons/truck. Transport trucks have a vibration level of PPV = 0.076 in/sec at a distance of 25 feet (FTA, 2018). The calculation of the potential impact of vibrations based on distance uses the Federal Transit Administration (2018) formula below.

PPVequip=PPVref x (25/D)^1,5

Calculations are carried out for vibrations generated from 1 dump truck. The results of the calculation of the impact at each distance are shown in Table 65.

Table 65. Estimated Value of Vibration at Specific Distance on the Passage

Distance		PPV	
feet	**meter**	**in/sec**	**mm/sec**
25	7,62	0,076	1,930
50	15,24	0,027	0,682
100	30,48	0,010	0,241
200	60,96	0,003	0,085
300	91,44	0,002	0,046
500	152,5	0,001	0,022

The calculation results show that the vibration generated by the dump truck operation on the main road is relatively small for the receptor distance of more than 7.62 meters. The magnitude of the impact of the noise will decrease as the distance of the receptors gets further. When linked to the interests of the surrounding community, the impact is categorized as a negative impact with a high enough intensity because it is estimated that there will be a mobility of trucks of 182 rotations/day. The impact of the vibration will be felt during the dam construction process which will last for ± 3.5 - 4 years. The assessment of the impact of vibrations on the access road is shown in Table 66.

Table 66. Vibration Impact Assessment along the Access Road during the Construction Stage

Impact	Increased vibration levels due to the mobilization of dump trucks from the Gunung Karang quarry to the main construction site.				
Impact Nature	Negative	Positive	Neutral		
	The vibrations resulting from the movement of the project vehicles is a negative impact that has the potential to disrupt the activities of residents, and buildings in the surrounding settlements.				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	Increased vibration is a direct impact arising from the operation of vehicles passing through the access road				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	The impact of the vibration is short-term because it will only appear during UCPS construction activities. Construction duration is ± 3.5 - 4 years.				
Impact Extent	Local	Regional	Global		
	The impact of the resulting vibration is localized at the locations through which the project vehicles pass.				
Impact Magnitude	No change	Slight	Low	Medium	High
	The vibration level generated from the dump truck operation at a distance of 7.62 m = 1.930 mm/sec, the vibration level decreases as the receptor distance is further away from the operational location of the truck on the main road. At a distance of 30 m it is 0.241 mm / sec, and at a distance of 150 m from the impact source the vibration level decreases to only 0.022 mm / sec.				
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
	The operational impact of project vehicles on the road is an activity that has a low-medium receptor sensitivity. This is because the level of impact is relatively small, but in intensity it is considered quite frequent with the movement of dump trucks being 182 rotations/day.				
Impact Severity	Slight	Low	Medium	High	Very High
	Impact magnitude low and receptor sensitivity low-medium resulted in impact severity low.				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood/Inevitable
	The impact of vibrations due to the operation of project vehicles will generally occur in construction activities.				
Significance	Negligible	Minor	Moderate	Major	Critical
	The low impact severity, with medium likelihood, results in a Negligible-Minor Significance.				

10.2.7.3 Main Construction

Rock blasting for the powerhouse, penstock and headrace tunnel structures has an impact of vibration around the activity site. The resulting peak particle velocity (PPV) vibration level is 2 kine (2 cm/sec). A peak particle velocity of 2 kine will result in an internal stress on the surrounding rock of 1.96 kgf/cm^2, lower than the internal stress threshold of the surrounding structures which reaches 2.4 kgf/cm^2 (Amdal, 2007). Thus, blasting does not cause significant vibrations to the surrounding structures.

The calculation of the vibration level resulting from the operation of the tools and machines used in the UCPS construction process refers to the Federal Transit Administration (2018). Based on the FTA (2018) the vibration levels generated from some construction equipment are as in Table 67.

Table 67. Vibration Source for Construction Equipment at 25 ft

Equipment		PPV at 25 ft	
		(in/sec)	(mm/sec)
Pile Driver (impact)	Upper range	1,518	38,55
	typical	0,644	16,35
Pile Driver (sonic)	Upper range	0,734	18,64
	typical	0,17	4,31
Clam Shovel drop (Slurry wall)		0,202	5,13
Hydromill (slurry wall)	In soil	0,008	0,20
	In rock	0,017	0,43
Vibratory Roller		0,21	5,33
Hoe Ram		0,089	2,26
Large Bulldozer		0,089	2,26
Caisson drilling		0,089	2,26
Loaded Trucks		0,076	1,93
JackHammer		0,035	0,88
Small Bulldozer		0,003	0,07

The distribution of vibration intensity from the impact source based on the Federal Transit Administration (2018) can be calculated using the equation below.

PPVequip=PPVref x (25/D)^1,5

The calculation result of the vibration intensity distribution (PPV) of the above construction equipment at a distance of 500 ft (152.5 m) is shown in Table 68.

Table 68. Vibration Source for Construction Equipment at 500 ft

Equipment		PPV at 500 ft (in/sec)	
		(in/sec)	(mm/sec)
Pile Driver (impact)	Upper range	0,01697	0,431
	typical	0,0072	0,183
Pile Driver (sonic)	Upper range	0,00821	0,208
	typical	0,0019	0,048
Clam Shovel drop (Slurry wall)		0,00226	0,057
Hydromill (slurry wall)	In soil	0,00009	0,002
	In rock	0,00019	0,005
Vibratory Roller		0,00235	0,060
Hoe Ram		0,001	0,025
Large Bulldozer		0,001	0,025
Caisson drilling		0,001	0,025
Loaded Trucks		0,00085	0,022
JackHammer		0,00039	0,010
Small Bulldozer		0,00003	0,001

Based on the State Minister for the Environment's Decree No.49 of 1996 concerning Vibration Level Standards, the vibration levels resulting from the operation of tools, machines, and vehicles in the table above at a distance of 500 ft (152.5 m) are still below the vibration level quality standards can be a building (2 mm/sec). The impact felt by workers is relatively small because they have been equipped with personal protection equipment. Based on the results of these calculations, it can be seen that the impact on the receptors is relatively small because not many settlements are located near the construction site. The vibration impact assessment at major construction sites is shown in Table 69.

Table 69. Vibration Impact Assessment at Major Construction Sites During Construction Stage

Impact	Increased level of vibration due to activities in the construction of upper weirs, lower weirs, and other supporting facilities				
Impact Nature	Negative	Positive	Neutral		
	Vibration resulting from blasting activities, and operation of construction tools and vehicles. Negative impacts have the potential to disrupt the activities of residents and buildings in surrounding settlements.				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	Increased vibration is a direct impact that arises from the construction and operation of heavy equipment, machinery and vehicles.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	The impact of the vibration is short-term because it will only appear during UCPS construction activities. Construction duration ± 3.5 - 4 years.				
Impact Extent	Local	Regional	Global		
	The impact of the resulting vibration is localized at the construction site.				
Impact Magnitude	No change	Slight	Low	Medium	High
	The vibration levels resulting from the operation of construction tools and machines at a distance of 25 ft ranged from 0.07 mm/sec to 38.55 mm/sec. Whereas, at a distance of 500 ft, the vibration level was reduced to 0.001 mm/sec to 0.431 mm/sec.				
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
	Blasting activity is an activity that has a low-medium receptor sensitivity. This is because in the vicinity of the construction site there are settlements that are less than 500 m apart but are not too dense. The level of vibration disturbs human activities, but is not expected to affect the integrity of buildings in settlements close to the project site.				
Impact Severity	Slight	Low	Medium	High	Very High
	Impact magnitude medium and receptor sensitivity low-medium resulted in impact severity medium.				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood/Inevitable
	The impact of vibrations due to the operation of project vehicles will generally occur in construction activities.				
Significance	Negligible	Minor	Moderate	Major	Critical
	The impact severity of medium with medium likelihood resulted in minor-moderate significance				

The results of the vibration impact assessment at the Gunung K,arang quarry location showed a major impact significance, while at the delivery road location it showed a negligible-minor impact and at the main construction site minor-moderate. Therefore, mitigation measures must be in place, specifically at the Gunung Karang quarry location. Mitigation details are described in Chapter 12 on environmental management plans.

10.2.8 Access to Water Sources in Gunung Karang Quarry

Andesite mining activities in Gunung Karang quarry will cause loss of, or change in the flow pattern of water sources in that location. In general, the water sources in Gunung Karang are local. Gunung Karang is not an aquifer area, groundwater comes from rainwater flows that infiltrate the fracture zone and the recharge zone in the higher elevation of the surrounding hills. Several statements from residents who were in the location of the activity noted the phenomenon of water sources coming out of Gunung Karang to the east of the mining location, after mining activities in the era of the Saguling reservoir construction took place. This water source is used for various community activities, including agricultural activities. This can at least prove the existence of water flow from the hills that comes out through the fracture zone in Gunung Karang. The surrounding hamlets use this water source (Bojongpari, Cimenet, Cisotong, Pasir Hideung, Kabakan Sari, Singadirja).

During the mining process, the water source from Gunung Karang cannot be used by the community. Based on the results of the 2011 UCPS AMDAL study, what might happen if mining is carried out in this area is an increase in the discharge of water, but with a shorter duration. The impact on the surrounding groundwater level has no effect because Gunung Karang is not an aquifer, meaning that the rainwater that enters above the surface of Gunung Karang is not transmitted into the soil layer below, but is directly released through the rock fractures that make up Gunung Karang. The impact assessment on water sources in Gunung Karang quarry is presented in Table 70.

Table 70. Impact Assessment on the Gunung Karang Quarry Water Resource

Impact	The loss of water sources in the Gunung Karang quarry due to andesite mining activities.				
Impact Nature	Negative	Positive	Neutral		
	Gunung Karang is a deposit of andesite rock; during cooling, molten lava does not flow perfectly, causing cracks to appear. Water from rainfall enters these cracks which leads to reduced surface runoff, and causes the rock to act like an aquifer. Mining of materials in Gunung Karang will reduce andesite deposits, leading to a loss of water source for nearby dependent communities and increasing run off.				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	Direct mining of Gunung Karang material will reduce andesite deposits, thus directly impacting on the reduction of water sources that are released from Gunung Karang.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	The impact that occurs with Gunung Karang mining is permanent because the deposit is lost.				
Impact Extent	Local	Regional	Global		
	The impact that occurs from mining on the availability of water resources is the area around Gunung Karang, because the water flow from Gunungkarang directly flows into the Cirendeu river.				
Impact Magnitude	No change	Slight	Low	Medium	High
	The impacts caused by Gunung Karang mining include reduced water storage resulting in more surface runoff.				
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
	The loss of water storage in the Gunung Karang quarry is an impact that will be felt by 6 villages in the area. This causes a high receptor sensitivity because the water source is used as one of the community's clean water sources.				
Impact Severity	Slight	Low	Medium	High	Very High

	Impact magnitude medium and receptor sensitivity medium-high resulted in impact severity medium.				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood/Inevitable
	The impact on the disruption of water resources in Gunung Karang is likely to occur				
Significance	Negligible	Minor	Moderate	Major	Critical
	The impact severity of high, with medium likelihood, resulted in Major Significance				

The impact significance of the loss of water resources in the Gunung Karang quarry is major so a mitigation is necessary. Mitigation measures are described in Chapter 12 on Environmental and Social Management Plans.

10.2.9 Terrestrial Biodiversity

10.2.9.1 Extent of Critical Habitat impacted

To determine whether there will be no measurable net reduction or negative change in those biodiversity values for which the critical habitat was designated, and no significant conversion or significant degradation of critical habitats, we assessed where Critical Habitat areas occurred in the wider landscape of the UCPS project area and along the access road and transmission line.

Before determining what net losses and net gains mean in this landscape, a clearer description is needed of the key ecological elements of the landscape that maintain the species triggering the Critical Habitat threshold. The UCPS landscape is strongly human-modified with a long history of conversion of forests to agricultural fields, and also maintenance of structural forest-type conditions in agroforestry areas. The terrestrial landscape is therefore a Modified Habitat, parts of which provide habitat to species triggering Critical Habitat. Species like Javan Leopard, Grizzled Leaf Monkey, and Slow Loris (Table 30) depend on core habitats such as the agroforestry elements in the landscape, as well as the ecological connections between these core habitats. Such connections can include land covers like open land or scrub, if these provide essential connections between two core habitats. In essence, this means that the entire landscape around the project site is Critical Habitat for species that have adapted to some extent to the human modifications in the landscapes. Figure 105 shows that around the project site a landscape exists of modified habitat that covers at least 15,000 ha. Some species, such as wide-ranging leopards might even use a larger landscape, dispersing to other forested parts of West Java.

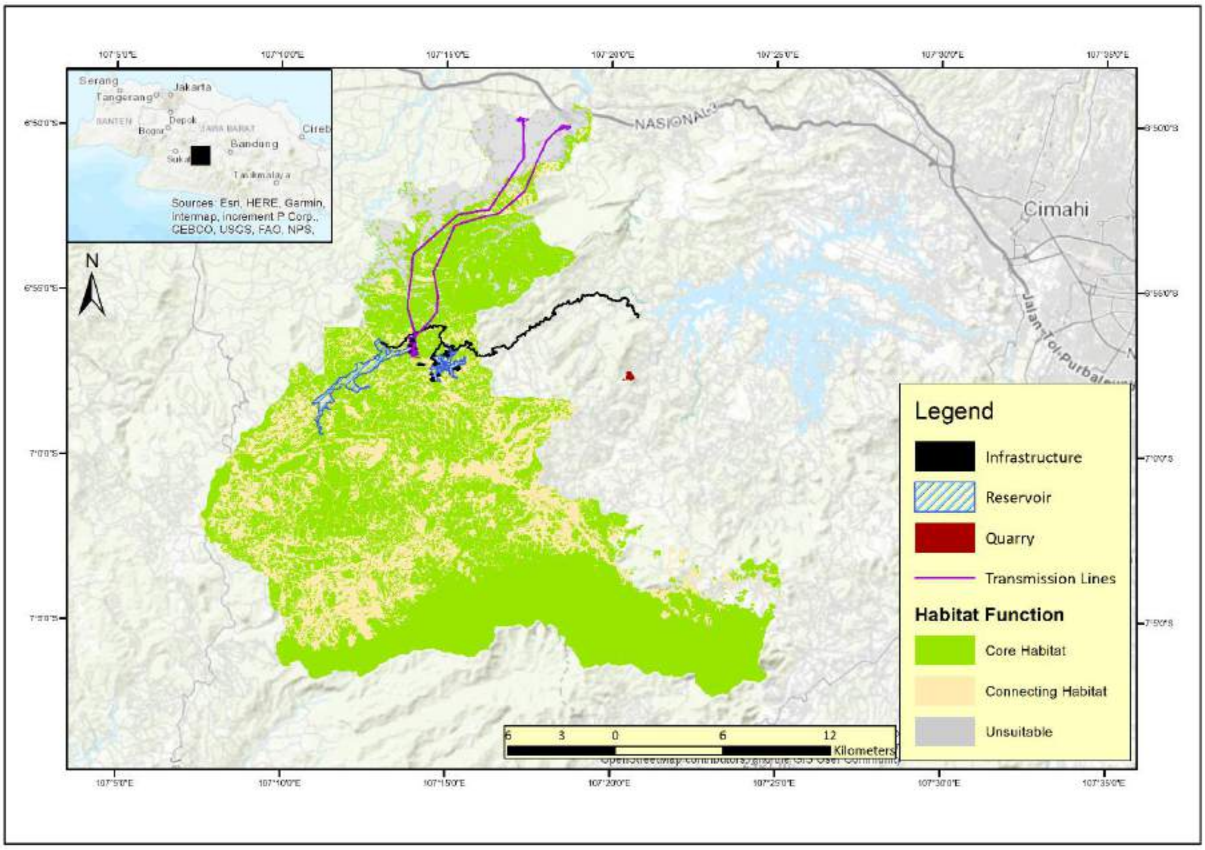

Figure 105. Larger landscape context of the project area with green areas indicating core habitats for the species trigger Critical Habitat and yellow areas indicating connecting habitat. No detailed recent land cover map was available for the area around the access road and quarry.

The presence records of species that trigger Critical Habitat are mapped in (Figure 106). This provides a general area of the core and connecting habitats that are important for maintaining these species. Species records are, of course, only available for the areas that were surveyed, and for all species that trigger Critical Habitat it is likely that their ranges extend beyond the surveyed areas. Nevertheless, this provides a first view on Critical Habitat near the project area (Figure 6). The size of the study area where species records were collected is approximately 2,688 ha, consisting of ca. 66% of agroforest areas where trees and tree crops are cultivated for human use, but which also provide important biodiversity habitat. This does not include the study area around the part of the access road closer to the quarry, where two locations were studied in 2009 but no species were found triggering Critical Habitat (Sutrisno et al. 2012). This study area above also does not include the field sites around the transmission line that were surveyed for biodiversity. The study area was selected on the basis of the assumption that this area would be influenced by project impacts.

Mapping the area of project infrastructure and inundated areas, indicates that the area of Critical Habitat that will be directly impacted by project infrastructure is ca. 400 ha (Figure 106 and Table 71). Indirect impacts are more difficult to estimate. They consist of a range of factors, such as, the construction of the access road to improve access, and relocation of people that could result in greater pressure on remaining forest stands. No data are currently available to more accurately measure the indirect impacts. Also, it is difficult to de-link these indirect impacts from the counterfactual (see section 2.11.2), since there is ongoing degradation and decline already. Taking a precautionary approach, we have considered the remaining part of the study area as being indirectly impacted, i.e., 2,688 ha minus 400 ha = 2,288 ha).

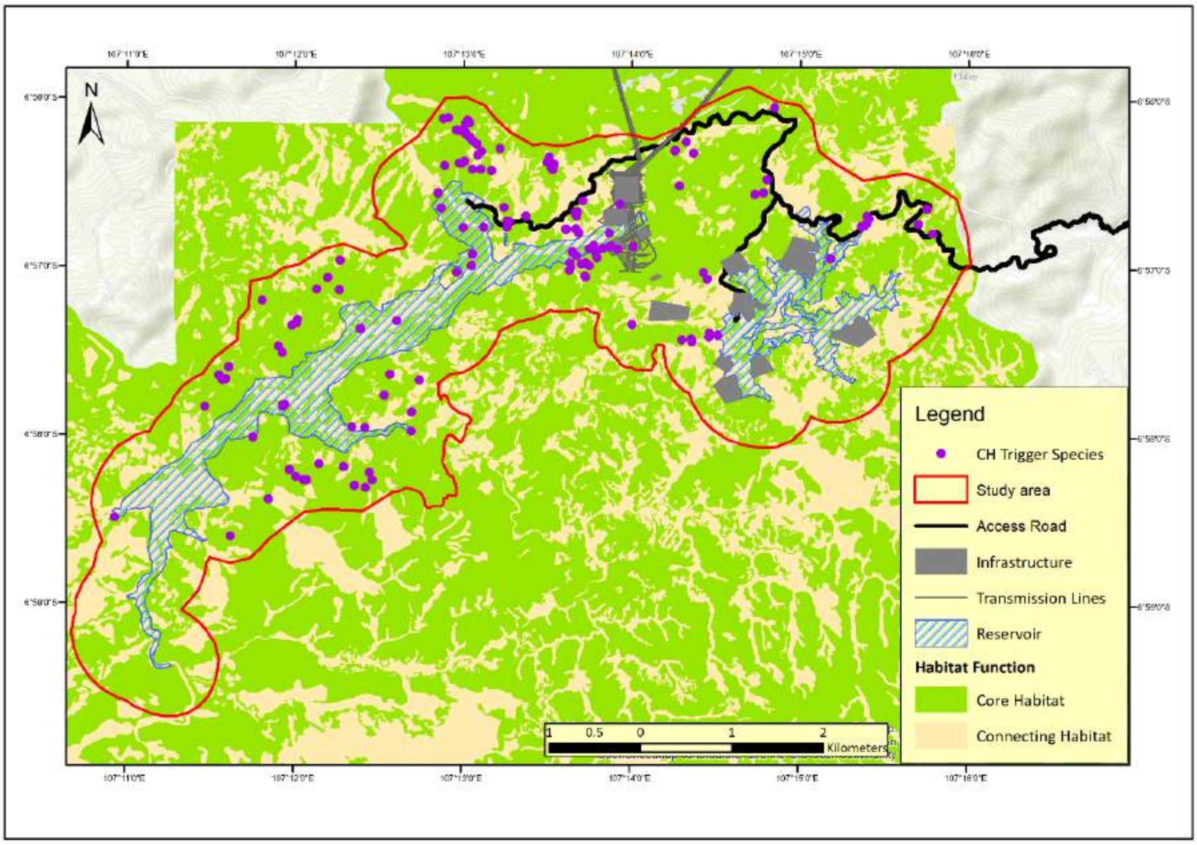

Figure 106. UCPS landscape showing land cover, presence of species triggering Critical Habitat, and the approximate extent of the study area in which these species have been assessed

Referring to ESS 6, the habitat around the transmission line sampling points is dominated by modified habitats because there is much human interference and the transmission line project site is not in a protected area. Several species that trigger Critical Habitat were found in forested parts of the transmission line route, and both directly and indirectly impacted areas were estimated above. Table 71 provides an overall indication of direct and indirect impacts from reservoir and transmission line development, resulting in a total of 2,629 ha of Critical Habitat impacted.

Table 71. Estimated areas of direct and indirect impacts on critical habitat

Area	Direct Impacts (ha)	Indirect Impacts (ha)
UCPS	400	2,288
Transmission Line	100	341
Estimated total impacts	500	2,629
Estimated total impacts based on counterfactual	500	1,867

As noted in the counterfactual analysis below, the prediction is that the Upper Cisokan agroforestry habitat could decline from 2,262 ha to 1,500 ha over a 30-year time period, indicating a loss of 762 ha that would occur even if the project was not implemented. It could thus be argued that the net loss of Critical Habitat caused by the project (i.e., considering the counterfactual of no project impacts) is 2,629 minus 762 ha = 1,867 ha of Critical Habitat indirectly impacted based on the counterfactual assumption.

10.2.9.2 Determining no net loss and net gain against a counterfactual scenario

ESS 6 requires that if Critical Habitats occur, then the project's mitigation strategy will be designed to achieve net gains of those biodiversity values for which the critical habitat was designated, i.e., net positive impacts need to be achieved. The IUCN has argued that net present impacts are most feasible when a counterfactual is used as a reference frame (Aiama et al. 2015). Establishing an objective baseline or reference frame for the original condition of the selected priority biodiversity values prior to project interventions is therefore an important part of a net positive impact approach. The project's progress towards achieving its net positive impact goals is evaluated against this reference frame. Two options exist for evaluating the outcomes of net positive impact goals: reference frames can be fixed baselines (i.e., known condition of biodiversity features at a fixed point in time) or counterfactuals [i.e., a scenario that would have occurred without the project interventions (Aiama et al. 2015)].

The UCPS landscape is undergoing change irrespective of the development of the project. Landcover change analysis between 2016 and 2019 indicates two main trends: 1) Loss of forest of ca. 4.4% over a 3-year period; and 2) Increase in agricultural land and settlements at a rate of 25% over a 3-year period (Table 72). This likely relates to an increasing human population in the area, possibly reduced yields from agricultural lands (loss of soil fertility and soil erosion) and thus the need to open up new land, and income from agriculture exceeding that from agroforestry. Without intervention such trends will likely continue to result in ever smaller forest patches and more agricultural land. Assuming a constant rate of decline, the agroforest area will be reduced to less than 1,500 ha by 2050. Especially where agriculture is developed on steep slopes, soil erosion will negatively impact sedimentation rates in the aquatic systems.

Table 72. Composition of landscape scale land cover in the UCPS area in 2016 and 2019

Land Cover	2016 (ha)	2019 (ha)
Agroforest and natural forest	2366	2262
Pine forest	10	10
Upland fields, rice fields and open lands	866	1066
Settlements	55	88
TOTAL AREA (incl. water and infrastructure)	3452	

The loss of forest habitat undermines the ecological viability of the area for maintaining forest species. This may already have resulted in the recent extinction of some species. For example, one individual of the Binturong *Arctictis binturong*, a large, frugivorous mammal species, primarily feeding on figs (*Ficus* spp.) (Nakabayashi and Ahmad 2018), was found in 2009 and 2012 in the Curug Walet forest area (Sutrisno et al. 2012, Husodo et al. 2019), but has not been recorded since (Husodo et al. 2019), suggesting it is likely extinct in the area. The species has large ranging requirements of ca. 6 km^2 (Grassman Jr et al. 2005), and its dependence on fruit species may have undermined its ability to persist in Cisokan's dwindling forest areas. Many bird species similarly are unlikely to survive in increasingly small forest patches (Diamond et al. 1987, Mardiastuti et al. 2019).

Not only habitat loss is threatening biodiversity under the counterfactual scenario. Unsustainable poaching and collecting rates are also threatening species, such as the commercially valuable Pangolin, and a range of songbird species that have been collected for many years in the area (Rahmat 2009). Many bird species that were once common in these kinds of lowland and hilly parts of Java are now extinct in the area and have never been encountered in recent surveys. This includes species like Crescent-chested Babbler (*Stachyris melanothorax*), Western Yellow Wagtail (*Motacilla flava*), Great Tit (*Parus major*), and Javan Myna (*Acridotheres javanicus*), which should be common in human-dominated areas on Java but have rapidly decreased populations because of bird hunting activities (Hakim et al. 2020). One fish species, *Hampala macrolepidota*, may also have disappeared because of unsustainable fishing.

Figure 107. Net gain scenario of the biodiversity offset against the counterfactual scenario and in relation to direct and indirect impacts.

The Forest Partnership Framework in the BMP provides the key strategy for addressing the restoration and offset components of the mitigation hierarchy. The framework is designed with a long-term goal to restore a connected (agro-)forest landscape across 3,800 ha of land around the UCPS reservoirs and project facilities. **The 3,800 ha of restoration aims to provide a net positive gain, offsetting the 500 ha of direct impacts and the 2,629 ha of indirect impacts, or 1,867 ha under the counterfactual scenario**. It simultaneously aims to restore the terrestrial biodiversity component by significantly increasing ecological connectivity among forest areas, benefiting species that trigger the Critical Habitat criteria, such as Slow Loris and Grizzled Leaf Monkey, and the aquatic habitat by improving ecological conditions alongside tributaries flowing into the reservoirs and through improved fish management. Finally, the restoration and offsetting strategies aim to fulfil socio-economic objectives through the development of financially viable social forestry and agroforestry programs. These aim to restore original agroforestry-based land uses in the UCPS area that provide communities with improved income and reduce ecologically damaging land practices, such as open field agricultural on steep slopes.

The biodiversity offset is additional to the losses that would have occurred under the counterfactual scenario (see Section 2.11.2). This scenario indicates that, assuming a constant rate of forest decline, the agroforest area will be reduced by 762 ha to less than 1,500 ha by 2050. The net positive gain targeted from the biodiversity offset against the counterfactual scenario is therefore estimated at **3,800 ha – 500 ha (direct) – 2,629 ha (indirect) + 762 ha (counterfactual loss) = 1,433 ha over a 30-year time frame** (Figure 108).

In conclusion, the counterfactual scenario is one of declining ecological values in an already heavily modified landscape, resulting in the extinction of species, especially larger forest-dependent species, such as gibbons and langurs. The question is whether the no net loss needs to take this counterfactual into consideration. Should the project's impacts be measured against the project's biodiversity baseline, or against the trend that would likely have occurred if the project had not been implemented? Either way, it is difficult in this environment to de-link the baseline with the project and it seems obvious that major ecological restoration is needed in the area to avoid further declines in biodiversity. This includes significant reforestation efforts with species that provide both social and environmental benefits. Such reforestation would increase the ecological viability of remaining forest patches from a current estimated 25% of what the ecological value would be in primary forest conditions, but also improve the quality of the aquatic system by protecting streams that flow into the reservoirs, providing improved fish spawning sites, better habitat for invertebrates, reducing the temperature of the water through increased shading, etc. The ecological restoration and biodiversity management objectives aim to increase the ecological value of the landscape from 25 now to 50% after forest restoration has been fully implemented.

10.2.9.3 Applying the mitigation hierarchy

ESS 6 states that for the protection and conservation of habitats and the biodiversity they support, the mitigation hierarchy includes biodiversity offsets. Offsets will be considered as a last resort, only if significant residual adverse impacts remain after all technically and financially feasible avoidance, minimization, and restoration measures have been considered (Figure 108).

The BMP has sought to avoid and minimize impacts where possible, through improved management of threats to wildlife (e.g., patrolling, community outreach, fire prevention), mitigating loss of ecological connectivity through road culverts and arboreal bridges, and other measures. As clarified in the analysis of the counterfactual, there is an ongoing trend, however, of biodiversity and habitat quality decline that occurs irrespective of the project's impact. The BMP is therefore focusing strongly on a major effort of ecological restoration that benefits both the terrestrial and aquatic systems, and provides benefits to communities, making it more likely to get their buy-in on sustainable (agro-)forest management and reducing threats to biodiversity (poaching, unsustainable collecting, poison fishing etc.).

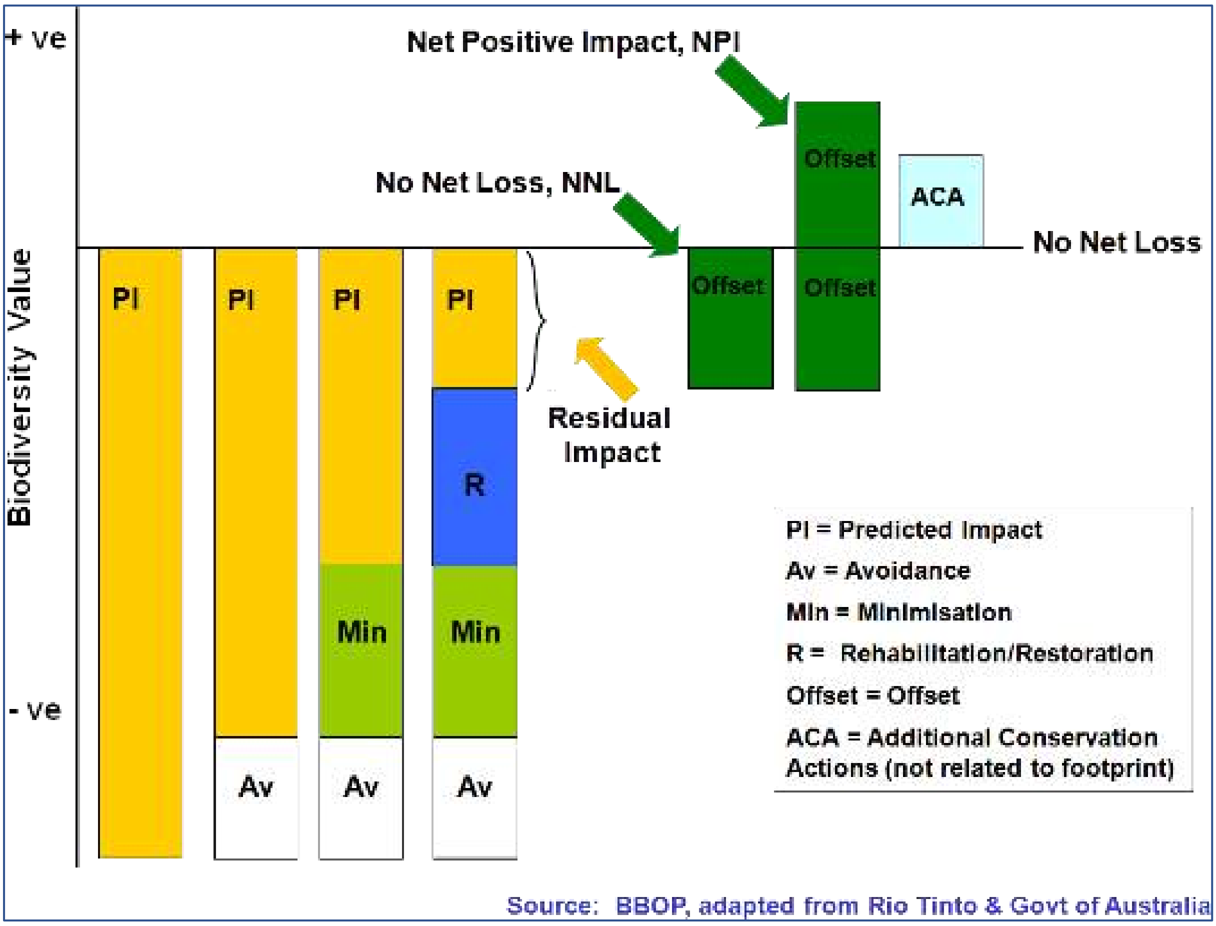

Figure 108. Mitigation hierarchy showing how different impacts relate to different mitigation measures

10.2.9.4 Offsetting losses in a sustainable development context

For the protection and conservation of habitats and the biodiversity they support, a biodiversity offset will be designed and implemented to achieve measurable, additional, and long-term conservation outcomes that can reasonably be expected to result in a net gain of biodiversity.

The Forest Partnership Framework in the BMP provides the key strategy for addressing the restoration and offset components of the mitigation hierarchy. The framework is designed with a long-term goal to restore a connected (agro-)forest landscape across 3,800 ha of land around the UCPS reservoirs and project facilities. The 3,800 ha of restoration aims to provide a net positive gain offsetting the 500 ha of direct impacts and the 2,191 ha of indirect impacts. It simultaneously aims to restore the terrestrial biodiversity component by significantly increasing ecological connectivity among forest areas, benefiting species that trigger the Critical Habitat criteria, such as Slow Loris and Grizzled Leaf Monkey, and the aquatic habitat by improving ecological conditions alongside tributaries flowing into the reservoirs and through improved fish management. Finally, the restoration and offsetting strategies aim to fulfil socio-economic objectives through the development of financially viable social forestry and agroforestry programs. These aim to restore original agroforestry-based land uses in the UCPS area that provide communities with improved income and reduce ecologically damaging land practices, such as open field agriculture on steep slopes.

10.2.9.5 Population Decline and Threats to Protected Wildlife in UCPS

The decline in wildlife populations due to the construction of the UCPS hydropower plant can be caused by: a). Degradation and loss of vegetation due to land clearing, construction of access roads as well as dams and its facilities (power houses, surge tanks, switch yards, inspection roads) which narrow down animal habitats; b) Increased hunting due to easy access via access roads; c) Project vehicle operations; and d) The potential for fire from the activities of workers and animal hunters.

Degradation and loss of vegetation can cause potential sites (such as shelters, feeding ground, reproduction sites) to be disturbed. Some populations of protected wildlife such as leopards, Javan gibbons, slow lorises, porcupines and pangolins, especially those in the Gowek-Pasir Nangka forest, are estimated to be threatened because their shelters and feeding ground are disrupted due to land clearing and road, and dam construction.

The existence of access roads and inspection roads will improve and facilitate access for hunters to areas that were previously somewhat difficult to reach, such as the Gowek forest, and the forests in Curug Walet and Curug Japarana. Currently, in the planned area of the UCPS hydropower plant, the community is still hunting animals. Construction activities on the access road can cause disturbance to animals. This happens because on the main road there are several areas that are inhabited by wild animals, such as the NR16-19 and NR23-25 areas and on the inspection road in the lower dam, switch yard, power house, and surge tank. In connection with the construction activities at the UCPS Hydroelectric Power Plant, the remaining pieces of wood and bushes left to dry around the activity site have the potential to trigger a fire. In addition to workers who carry out activities around the location, local residents are also very likely to do activities in this area. Activities of workers and residents that have the potential to cause fires include inappropriate disposal of cigarette butts, cooking fires, burning trash, or *ngahuma*. This activity is a threat to the survival of wildlife around the hydropower plant project site. An assessment of the impact of population decline and threats to protected wildlife is shown in Table 73.

Table 73. Impact Assessment of Population Decline and Threats to Protected Wildlife at UCPS Construction Stage

Impact	Population Decline and Threats to Protected Wildlife				
Impact Nature	Negative	Positive	Neutral		
	The decline in population as well as threats to protected animals, has the risk of causing an imbalance in the ecosystem				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	(Agro)-forest habitat loss, hunting of wildlife, construction activities, and potential fire cause pressure and threats to the wildlife population around the hydropower plant				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	The decline in wildlife populations caused by the loss of vegetation will be long term, however PLN will carry out revegetation to restore habitat conditions for wildlife.				
Impact Extent	Local	Regional	Global		
	The impact occurs on the project site				
Impact Magnitude	No change	Slight	Low	Medium	High
	This decline in population and threats to wildlife has a medium impact, because it is focused on the remaining forest between Gowek and Pasir Nangka which is a shelter and feeding ground, but these areas are key remaining habitats for species in a landscape that is rapidly being degraded by forest conversion for agriculture.				

Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
	The area of the wildlife habitat in the Gowek-Pasir Nangka forest is limited. Construction activities will narrow the habitat, while the area around it is a cultivated area that lacks potential as habitat. Therefore, it is feared that in the next few years the population of various animal species in the area will shrink and there is a potential for local extinction to occur.				
Impact Severity	Slight	Low	Medium	High	Very High
	Medium impact magnitude and medium-high receptor sensitivity resulted in high impact severity.				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood/Inevitable
	Monitoring data and field surveys indicate high likelihood of impacts, adding to ongoing counterfactual pressures on habitat and wildlife populations				
Significance	Negligible	Minor	Moderate	Major	Critical
	The high impact severity with high or inevitable likelihood resulted in Major Significance.				

10.2.9.6 Transmission Line Impacts

The environmental and biodiversity impacts of the transmission lines can be categorized into three main problems, each requiring specific mitigation strategies: (1) Electrocution; (2) Collision; and (3) Habitat loss and fragmentation. There are also some potentially beneficial impacts of transmission lines. For example, powerline infrastructure is regularly used by numerous bird species for roosting, foraging and hunting, nest building, and rearing young. Species range from small birds that perch on powerlines to much larger birds (e.g., eagles) (Hunting 2002). Ospreys (*Pandion haliaetus*) or White-bellied Sea-eagles (*Haliaeetus leucogaster*) nest on towers, for example. Nesting can, however, cause transmission outages, or even fires, if nest materials or feces provide a pathway for electrical current. Power outages can also be caused by snakes (see below) and avoiding these are both important from the perspective of financial risk management and biodiversity protection.

10.2.9.6.1 Electrocution risks

Electrocution from power infrastructure threatens many mammal species, yet knowledge of effective evidence-based mitigation strategies is limited (Katsis et al. 2018). Roosting fruit bats and gliding mammals (flying squirrels, colugos), as well as large carnivores, including leopards (Kolnegari et al. 2018) are sometimes killed through electrocution. Electrocutions of primates tend to be concentrated in particular locations along the powerline structures, as shown in studies in India (Ram et al. 2015), Bangladesh (Al-Razi et al. 2019), Brazil (Lokschin et al. 2007) and Kenya (Katsis et al. 2018) and disproportionately affect species that are commonly using horizontal structures, such as slow lorises (*Nycticebus*) and langurs (*Trachypithecus sp.*) (Al-Razi et al. 2019). There have been anecdotal stories of slow lorises between electrocuted on Java, but this was likely on smaller transmission line infrastructure (V. Nijman, pers. comm.).

Mortality of snakes from electrocution on powerlines are anecdotally documented but have not been well studied. Larger, climbing snakes such as pythons could be at particular risk. For example, on the island of Guam, the Brown Tree Snake (*Boiga irregularis*), which is non-native species on Java, causes frequent electrical power outages, especially on high voltage transmission lines, on transformers, and inside electrical substations (Fritts 2002). These snakes caused more than 1600 power outages in a 20-yr period, with a single outage spanning the entire island and lasting 8 or more hours estimated to cost in excess of $3,000,000 in lost productivity.

Avian electrocution can occur if a bird simultaneously contacts either two phase wires or an energized phase wire and a grounded (earthed) contact, such as a steel member. Avian electrocutions can cause line faults and outages that negatively impact system reliability and power quality. Due to behavioral factors, raptors are more susceptible to electrocution than other groups of birds (Eccleston and Harness 2018). For Java, the raptor species that are most likely to be affected are Crested Serpent Eagle (*Spilornis cheela*), Crested Hawk-Eagle (*Nisaetus cirrhatus*) or Black Eagle (*Ictinaetus malaiensis*) that might perch or nest on power infrastructure, and which have all been identified in the transmission line area. Storks, herons and egrets can also be affected, although no stork species have been recorded in the UCPS or transmission line areas.

10.2.9.6.2 Collision risks

Collisions with transmission infrastructure are mostly a problem for birds. Bird collisions most often occur in raptors, species with either poor maneuverability (e.g., egrets), fast fliers, such as imperial pigeons (*Ducula spp*.) and quails (Janss 2000), or waterbirds, such as ducks and rails (MWH and Stantec 2018). For Java, the raptor species that is of most concern for being affected by the transmission infrastructure is the endemic and Endangered Javan Hawk-eagle (*Nisaetus bartelsi*). Furthermore, migratory species that, during the September to November migration, pass west-to-east through the Javan highlands and areas to the north, (Nijman et al. 2006) could collide with towers or powerlines (Figure 109). This includes Chinese Goshawk (*Accipiter soloensis*), Japanese Sparrowhawk (*Accipiter gularis*), Oriental Honey-Buzzard (*Pernis ptilorhynchus*), Black Baza (*Aviceda leuphotes*), and Short-toed Eagle (*Circaetus gallicus*).

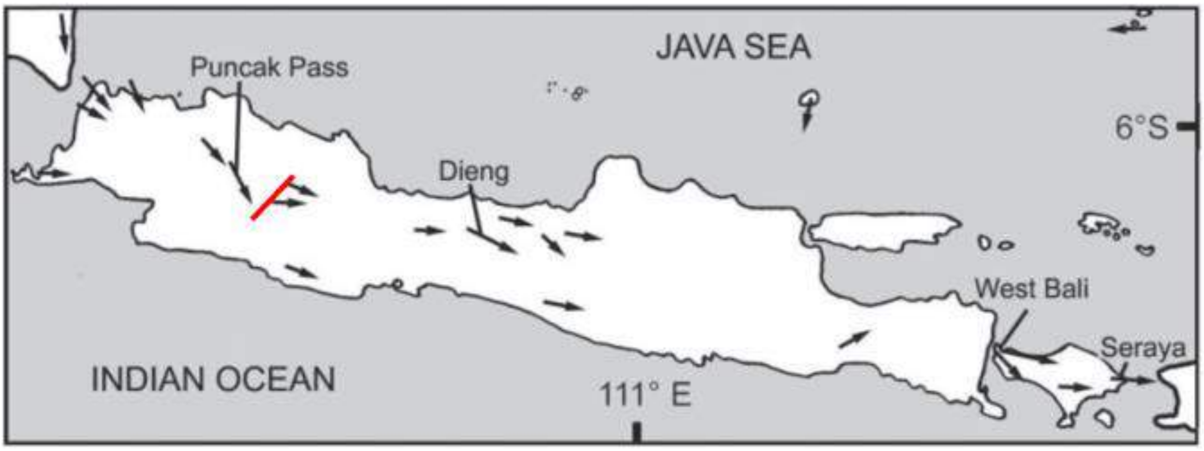

Figure 109. Map showing general direction across Java of September – November raptor migration, which follows a general course through and north of the central mountain range on the island, and runs perpendicular to the main transmission line route (Nijman et al. 2006). Red line indicates the approximate location and direction of transmission lines.

10.2.9.6.3 Summary Electrocution and Collision Risks

No systematic studies exist in Indonesia that have quantified the risk of transmission infrastructure to wildlife. The risk of electrocution and collision is, therefore, difficult to estimate. Collision by birds and electrocution of birds, mammals and reptiles are key concerns, with the latter also ensuing potentially large costs for the company if animal electrocution leads to power outages. It is easier to mitigate these risks during the construction phase, when mitigation measures are a small part of the budget, than during the maintenance phase when such measures are relatively more expensive (Prinsen et al. 2012). The precautionary principle should therefore be kept in mind when identifying mitigation needs.

No Critically Endangered species are likely to be impacted by electrocution or collision risks in the UCPS transmission line area, although there might be some electrocution risk to slow lorises. The transmission lines, however, run perpendicular to an area likely important for the Asian Flyway bird migration route, with significant increase in raptor presence in the region during the September to November migration season. Furthermore, the habitat of at least two Critically Endangered species, Slow Loris and Pangolin (and likely also Leopard) will be affected by forest clearing for transmission line development in the forested part of the transmission route.

10.2.9.6.4 Habitat Loss and Fragmentation from the Transmission Line

Mapping results show that >50% of the land cover in the transmission line route is forest, with the remainder mostly consisting of fields and rice fields, and settlements. Two Critically Endangered mammal species, Pangolin and Slow Loris, were identified to be present in the transmission line area. Within the forest area, the transmission line will require opening up 20-40 m of land around the line, creating a significant barrier for forest dependent species. The species that will likely most be affected are those that avoid coming to the ground such as Slow Loris and also Grizzled Leaf Monkey. In places where the access road provide access to forests that did not previously occur, the risk of catching and hunting of birds, mammals and other species also increases.

The total length of the new transmission line is 31.4 km, with a width of 20-40 m, requiring an area of over 100 ha of cleared land, of which 50% is in secondary and plantation forest. No primary forest occurs along the transmission line route. The two Critically Endangered mammal species indicate that the forest areas converted for the transmission line are Critical Habitat. The Slow Loris will be affected by the significant non-forest barrier as it is a forest-dependent species. Other primates such as the Grizzled Leaf Monkey will also be affected as they need to come to the ground to cross the non-forest barrier, where they are more likely to be hunted. Where new roads are built into forest areas, increased access will increase hunting pressure and deforestation risks. Elsewhere on Java, it was found that proximity to roads is a driver for land use and land cover change, particularly up to 1 km from the road but tapering off further than a kilometer away (CarbonTropic 2017). Published research also shows that a 1 km buffer around roads represents an indication of indirect impacts from increased hunting, which decline linearly with distance from roads (Clayton et al. 1997, Laurance et al. 2006). Access to forests via transmission line routes will be much more difficult than roads due to the lack of vehicle access or ability to settle and use land within the corridor. It is, however, possible, due to land pressures in Java, that the cleared route could increase informal agriculture, settlement and hunting in the project area, even without road access. Indirect impacts on critical habitat are therefore estimated at 31.4 km (transmission line length) * 0.5 (percentage in forest) * 0.2 km (zone indirectly impacted, applying lower rate of impact compared to roads) = 314 ha indirectly impacted.

10.3 Land Acquisition and Resettlement Impacts

The Project requires 752, 39 ha of land for the access road, upper and lower reservoir, and transmission line. Identified impacts due to land acquisition include loss of land, houses/buildings/ other assets experienced by the landowners; loss of/ damage to public infrastructures such as schools, mosques, water sources, roads, bridges, and sewage water systems; and loss of forest land. The LARAP documents provide mitigation measures to address the impacts above, including payment of cash compensation for loss of land and assets; protection, relocation, and rehabilitation of affected public facilities; replacement of forestry land and budget provision for revegetation; livelihood assistance and restoration programs. There are several villages that are affected directly by the project, namely Sukaresmi village, Bojongsalam village, Karangnunggal village and Cicadas village.

A Review on the Implementation of the LARAP was held from February to November 2020 by independent consultants. Detailed information is available in LARAP Implementation Review Report, 2021. Key findings include:

- Access roads with a total of 55.1 ha have been fully acquired and 562 landowners have been fully compensated. A total of 251.85 ha owned by 891 landowners of upper and lower reservoir have been compensated. There is a need for approximately 3.4 ha of additional land owned by 37 Households which will be confirmed and processed in the next phase of the project. 59 landowners of a total of 2.70 ha for transmission line construction have been compensated. Only one owner (of 0.05 ha) has not received compensation as the owner lives in another province.
- 2.12 ha of unviable lands have been identified in West Bandung Regency. Identification of similar land in Cianjur Regency has not commenced. None of the unviable land has been compensated. This will be followed up by PLN.
- PLN will need to follow up on replacement/ compensation for affected village treasury land and waqf land.
- There are 765 households that must be relocated from the impacted area. A total of 199 households in the access road were relocated within the same village, while 566 households of PAPs in the reservoir area must be relocated to other villages. 54 households have not relocated for various reasons. Reportedly, 12 households will move as soon as PLN builds a mosque in their resettlement area. The rest of the households expressed other reasons including running out of compensation money and therefore being unable to afford a new house in another area, waiting for PLN to build religious/worship facilities in the new resettlement area, and other personal constraints. Although all PAPs opted for self-relocation, meaning managing their own relocation process after receiving cash compensation, PLN supported construction of public facilities in 2 resettlement locations.
- PLN has implemented economic assistance and livelihood restoration programs, benefiting the PAPs.

At the moment, the new PAPs' destinations of settlement locations are including:

1. Households affected by inundation (upper reservoir)
    a. Jegud/Tapos Sand Sub-village, Sukaresmi Village, Rongga Sub-district, West Bandung District.
    b. Cidongke Sub-village, Bojong Village, Rongga Sub-district, West Bandung District.
    c. Munjul Sub-village, Bojong Village, Rongga Sub-district, West Bandung District.
    d. Santik Sub-village, Bojong Village, Rongga Sub-district, West Bandung District.

b. Cihaneut Sub-village, Bojong Village, Rongga Sub-district, West Bandung District.

2. Households affected by inundation (lower reservoir)
    a. Cangkuang Sub-village, Bojongsalam Village, Rongga Sub-district, West Bandung District.
    b. Jolok Sub-village, Cicadas Village, Rongga Sub-district, West Bandung District.
    c. Gunung Batu Sub-village, Desa Cicadas, Rongga Sub-district, West Bandung District.
3. Households affected by inundation in switchyard
    a. Laja Sand Sub-village, Sukaresmi Village, Rongga Sub-district, West Bandung District.
    b. Babakan Sub-village, Bandung, Sukaresmi Village, Rongga Sub-district, West Bandung District.

There is a potential of additional land acquisition required for the construction of ancillary facilities such as a workforce base camp, surge tank, spoil bank, and access to a powerhouse. Referring to the estimated plan in the LARAP Report, the additional land requirement above private lands is estimated to be less than 5 ha. The Land Acquisition and Resettlement Policy Framework (LARPF) has been developed to guide future land acquisition. The requirement for additional land is maximized by using Perhutani's land and areas that have obtained a Borrowing-Use Permit from the Ministry of Environment and Forestry (KLHK). However, if the suitable land is located outside the area that already has a permit from the KLHK, then PT. PLN needs to submit a change in the permit area to the KLHK. Besides, land acquisition is also possible on land owned by individuals (non-forest). However, Area Switchyard is given a priority to ensure safety slope protection, and also because it is above private land.

The additional land requirement location was not set-in stone, but the acquisition could have affected the community who has the land or livelihood in those areas. Table 74 summarizes impacts from land acquisition and resettlement.

Table 74. Land Acquisition and Resettlement Impacts

Impact	The acquisition for additional land could have affected the community who has the land or livelihood in those lands.				
Impact Nature	Negative	Positive	Neutral		
	The relocation process moves residents away from disturbances that can occur during the project The additional land acquisition prohibits the use of the acquired land by people.				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	The land acquired has a direct effect on the landowners or the livelihood residents				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	People who have to move cannot occupy their land because the land is used by PLN as a project area				
Impact Extent	Local	Regional	Global		
	The level of impact will be local, limited to the project area that will be acquisitioned				
Magnitude	No change	Slight	Low	Medium	High
	The magnitude of the impact will be at the medium level, as only residents whose areas are acquisitioned will be affected.				
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
	The receptor sensitivity is at a medium level where the transaction allows room for negotiation for landowners, including the option of refusal if there are no mutually agreed terms				

Impact Severity	Slight	Low	Medium	High	Very High
	The combination of medium impact magnitude and medium receptor sensitivity categorizes the impact level as medium. Land buyers and owners have equality in negotiations.				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood/Inevitable
	While there will be no construction activities on the land before an agreement is made, the land acquisition has been planned and estimated				
Significance	Negligible	Minor	Moderate	Major	Critical
	The combination of high likelihood and medium impact severity will produce a Moderate Significance impact.				

Mitigation:

1. Implementation of proposed action plan identified in the LARAP implementation review report to complete the identified outstanding tasks and issues
2. Implementation of LARF for the additional land acquisition.

10.3.1 Livelihood Changes

10.3.1.1 Livelihood Changes Forestry Dependent Livelihood

Access road construction for the Project has been completed. Prior to access road construction, the majority of the people in communities surrounding the project area worked as farmers or other agriculture-related occupations. After the road construction, mobility of the younger working-class group out of the village is higher, hence, the number of youths moving to urban areas to work as factory workers have also increased. Various employment opportunities were made available to various productive resources increased. Various PAPs' products are expanded to wider markets, including Bandung City and other smaller cities

Various new jobs and businesses have emerged along the new roads, such as mechanics (workshops), grocery traders, traveling traders, electronic traders (television, mobile phones, vouchers, internet quotas, and others), and transportation services (motorcycle taxis, rural transportation, freight transport). Nevertheless, the majority of the community still work in farming including in paddy, horticulture, forestry land cultivation, and as farm labors and agricultural product traders. There are many PAPs who were rice farmers (especially those who live in Sawah Sub-village and New Road) who no longer own rice fields, they have relocated to new settlements which previously almost entirely consisted of dry land. The PAPs still hold status as farmers, however, the commodities farmed have changed and the farming system has shifted from paddy to *huma* farming.

The utilization of forest land for *huma-ladang* was carried out by approximately 1658 households in 38 hamlets in the northern part of the project site plan, including Sukaresmi Village in West Bandung Regency and Sukarama and Karang Nunggal Villages in Cianjur Regency. The *huma- ladang* was also carried out by residents living in villages to the south of the project site plan. However, this activity was not indicated as being as intensive as the activity carried out by the residents in the northern part of the project.

The dam will be constructed in forestry land managed by Perhutani, which will cause loss on the forestry land and consequently to the people who use the forest resource. Therefore, due to the construction stage and the establishment of the restoration area, there will be an impact on the community whose livelihood depends on the forest managed by Perhutani.

Table 75. Impact Assessment on Livelihood Changes

Impact	Livelihood changes of communities dependent on Forestry lands.				
Impact Nature	Negative	Positive	Neutral		
	Livelihood changes can have a negative impact, but also provide new opportunities through more sustainable resource use and new jobs				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	The impact of construction on society will directly impact the forest-dependent communities				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	Livelihood changes are considered to be permanent, especially since the forestry land will be used as a location to construct dam, the surrounding area also will be restricted from access.				
Impact Extent	Local	Regional	Global		
	The level of impact will cause local impact because it will only impact the community who use the forest resource				
Magnitude	No change	Slight	Low	Medium	High
	Impact magnitude at medium level. The community could change their livelihood caused by loss on the forestry land				
Receptor Sensitivity	Low	Low-Medium	Medium	Medium High	High
	The livelihoods of the communities around the UPS Project were dependent on forest resources.				
Impact Severity	Slight	Low	Medium	High	Very High
	The combination of impact magnitude at medium level and receptor sensitivity at medium level resulted in impact severity at high level.				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood/Inevitable
	With the construction of the Cisokan hydropower plant, it is inevitable that the affected communities whose livelihoods are related to land will change.				
Significance	Negligible	Minor	Moderate	Major	Critical
	The combination of high likelihood and medium level impact severity will produce an overall Major Significance impact.				

Mitigation:

Implementation of Forest Partnership Action Plan which focuses on livelihood restoration of the local communities. This also includes integrated management of biodiversity in the Restoration Area covering 15 Biodiversity Important Areas (BIAs), six corridors, and Buffer zones.

10.3.1.2 Livelihood Changes in Woman Landowners

Livelihood restoration and income rehabilitation programs for the affected landowners were carried out by PT. PLN in collaboration with the Office of Social Affairs and Manpower, the Village Community Empowerment Agency, and the Office of Small and Medium-sized Enterprises (UMKM). Some economic restoration programs are only targeted to certain groups of PAPs, including women's groups, assistances for local food processing, cooking and local products packaging (food and handicrafts).

LARAP implementation review report confirmed that the role of women in regulating the productive sector tends to increase, both in the agricultural sector and in micro, small and medium enterprises. The trend of increasing the role of rural women in business management occurs in line with the increasing number of male migrants in urban areas. The roles of women have increased, particularly in the stalls, trading, and handicraft business. This indicates a shift in the composition of 'breadwinner' within PAP households, from being previously dominated by the male household heads (husbands) to the women. This circumstance also shows that income generating activities conducted by the wives have the potential to be developed. Becoming food-processors, village officials, Islamic boarding school caretakers, and property traders are just a few of the professions.

Table 76. Impact Assessment on Women Land Owners Livelihoods

Impact	Changes in the livelihoods of women land owners				
Impact Nature	Negative	Positive	Neutral		
	Women are given more responsibility to improve their livelihood and income				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	The impact of construction will directly impact communities.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	Changes in the livelihoods of the affected women are considered to be permanent, especially by the people who are directly affected at the project site.				
Impact Extent	Local	Regional	Global		
	The level of impact is localized because the alternative types of work are still on a micro scale, except for cooperatives that have been directly fostered by the district UMKM Office				
Impact Magnitude	No change	Slight	Low	Medium	High
	Impact magnitude is at a medium level. The community gets new livelihoods and economic activities in the vicinity because of improved road access.				
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
	Receptor sensitivity was at a medium level where changes in livelihoods were felt by the community, including the emergence of job opportunities for women. Data are lacking on specific impacts on the elderly and disabled.				
Impact Severity	Slight	Low	Medium	High	Very High
	The combination of impact magnitude at medium level and receptor sensitivity is at medium level so that the impact severity is at high level				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood/Inevitable
	With the construction of the Cisokan hydropower, it is inevitable that the affected communities whose livelihoods are related to land will change. Women in particular experienced a significant change from farming to trading.				
Significance	Negligible	Minor	Moderate	Major	Critical
	The combination of high likelihood and high level impact severity will produce an overall Major Significant impact.				

10.3.2 Demographic Change

Construction activities carried out in the UCPS area will bring in construction workers from outside the area. An increase in the number of people caused by construction workers' arrival can potentially bring changes to demographics in the future.

Table 77. Impact Assessment on Demographic Changes

Impact	Increase in the community population in the project area due to the influx of newcomers				
Impact Nature	Negative	Positive	Neutral		
	Demographic changes are Neutral in nature				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	The impact results from direct interactions between construction workers/new arrivals and the community				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	The increase in population occurs during the construction and operational periods, given there is a relationship between project workers and the community in the UCPS area				
Impact Extent	Local	Regional	Global		
	The population increase will occur in the UCPS area				
Magnitude	No change	Slight	Low	Medium	High
	The community will interact with newcomer/project workers during the project, especially people living in the UCPS area. However, construction workers are expected to leave the UCPS site after the project ends.				
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
	Based on consultations, UCPS local communities have a character that easily accepts new people and can adapt to the arrival of newcomers/project workers.				
Impact Severity	Slight	Low	Medium	High	Very High
	The combination of the impact magnitude at the low level and the sensitivity of the impact recipient is at the low-medium level which resulted in impact severity at the low level				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood/Inevitable
	There is a medium likelihood that relationships between newcomers and the community are established which could increase the population of the community in the UCPS area				
Significance	Negligible	Minor	Moderate	Major	Critical
	The combination of the medium likelihood and impact severity at the low level will result in an overall Negligible Significance impact.				

10.3.3 Impact on Income Associated with Construction Activities

The project activities can affect the increase in economic activity around the area. For example, opening up business opportunities that also provide benefits such as food and services during the construction period, which can contribute to economic prosperity. Based on the LARAP midterm report in 2016, there was a significant change in the income of the project affected residents (Table 78). As much as 52.33% of respondents experienced an increase in income.

Table 78. Impact Assessment on Income Related to Construction Activities

Impact	The construction process of the Cisokan hydropower plant and its access roads will have an impact on the income of the surrounding community				
Impact Nature	Negative	Positive	Neutral		
	The construction activities will provide the community with new business opportunities (for income).				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	Construction activities open up opportunities for people to new sources of income.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	The impact on community income will be permanent because community is provided a new market during the construction phase and opportunities to expand business with the access road.				
Impact Extent	Local	Regional	Global		
	The level of impact will be local, limited to the project area				
Magnitude	No change	Slight	Low	Medium	High
	The magnitude of the impact is at the medium level, because of a potential increase in community income due to the arrival of potential customers and the opening of easier access to the UCPS area				
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
	Community sensitivity to the impact of income changes is at low-medium levels. The community will be able to take advantage of opportunities by opening kiosks and increasing the distribution of village produce to improve the economy.				
Impact Severity	Slight	Low	Medium	High	Very High
	The combination of the impact magnitude at the medium level and the impact receptor sensitivity at the low-medium level results in the impact severity being at the medium level.				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood/Inevitable
	The likelihood of the impact occurring is at the medium level.				
Significance	Negligible	Minor	Moderate	Major	Critical
	The combination of medium likelihood and impact severity at medium level will result in a minor-moderate impact overall.				

10.3.4 Risk of Labour from Outside the Project Area

Labor influx risk has been assessed as high with an increase in workers during peak estimated to be 2700 with approximately 4500-6000 followers. (Table 79). There is a shortage of skilled labor which has required sourcing of skilled workforce from other areas of the country. The additional population will likely strain local community dynamics, as well as burden local infrastructures and public service provisions, such as the health systems. There is an increased risk of illicit behavior or crimes, GBV, substance abuse, prostitution, and human trafficking as well as associated health risks with communicable diseases such as STDs.

The infrastructure project is followed by the mobilization of workers at the project site. This can cause fundamental changes in social life. One thing that needs to be anticipated is the emergence of various sexual behaviors that occur between community groups and workers which then lead to gender-based violence such as prostitution, human trafficking, child marriage and other types of violence against vulnerable groups (women, children, disabilities and the elderly). This is as conveyed in the final report of the social and stakeholder mapping program for the construction of PLTA UCPS in West Bandung Regency (2019) which revealed that in one of the affected villages, commercial sex workers had emerged in the project area.

Table 79. Impact Assessment on Workers from Outside UCPS to Social Activities in the Project Area

Impact	Potential risks of illicit and unsolicited behaviors, such as crimes, GBV, substance abuse, prostitution, and human trafficking as well as associated health risks with communicable diseases such as STDs				
Impact Nature	Negative	Positive	Neutral		
	The arrival of workers from outside the project area will have a negative impact on the social community around the project				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	Even though the impact will be felt directly by the community, the impact is indirectly caused by the project.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	The impacts will initially be short-term during the construction process, but because of lasting changes in the area, the impact duration is considered to be long-term.				
Impact Extent	Local	Regional	Global		
	The level of impact will be local, limited to the Project location.				
Magnitude	No change	Slight	Low	Medium	High
	The impact can even lead to illicit/unsolicited behaviour in the location that leads to social issues.				
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
	The community tends to be open to accepting newcomers who are workers in the Cisokan project. Outside workers also have a good perception in the eyes of the community which facilitates interaction between them.				
Impact Severity	Slight	Low	Medium	High	Very High
	The combination of the impact magnitude at the high level and the impact receptor sensitivity at the medium-high level results in the impact severity being at the high level				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood/Inevitable
	Previous construction activities indicated that project workers who came from outside the male-dominated areas tend to interact with residents around the project				
Significance	Negligible	Minor	Moderate	Major	Critical
	The combination of medium likelihood and impact severity at high level will result in a Major Significance impact overall.				

Mitigation

Mitigation measures addressing potential risks and impacts resulting from incoming workers are provided in the SCMP document.

10.3.5 Impact on Cultural Heritage

Cultural heritage is present either in the form of tangible cultural objects or intangible cultural activities, such as ceremonies and rituals. There are no sites registered with local and national authorities with legal and important protection of cultural heritage. However, some sites need attention because of their religious or cultural significance, such as graves considered sacred by local communities and pilgrims. There are also many private burial sites and religious structures within the project area, which should also be respected and protected during reservoir construction and preparation.

A Physical Cultural Resource survey, which includes religious buildings and private graves, which was 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 is presented in the standalone document (App-E_UCPS Physical Cultural Resources Survey Report 2009). None of the sites registered with local and national authorities have legal or important protection. Locations that have particular importance, 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 ustadz graves). However, there are also many private graves and religious structures within the project area which should also be respected and protected during reservoir construction and preparation.

Based on the interviews related to Land Acquisition Committee (Panitia Pengadaan Tanah - P2T) with the land division of UIP PLN, it revealed that with the abolishment of P2T most land acquisitions were regarded to have been completed, with the exception of remaining lands (TKD and waqf (mosques and madrasah) and surrounding land). The land compensation process was carried out during the period of 2014 to 2016, with a total of 222 tomb sites compensated for.

One intangible object of note is the interesting traditional ceremony associated with farming activities, this is called the *Mantra Tandur* in Karangnunggal Village, Cibeber District, as described in the baseline. The *Mantra Tandur* tradition has the potential to be affected by dam construction and the availability of water during the rice planting period, therefore the impact on intangible culture needs to be considered to maintain the *Mantra Tandur* ceremony.

Table 80. Impact Assessment on Intangible Cultural Heritage

Impact	Impact on intangible cultural heritage of the *Mantra Tandur*, as well as private graves and religious structures within the project area.				
Impact Nature	Negative	Positive	Neutral		
	The impact on cultural heritage during construction and operation will be negative.				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	Cultural heritage and related sites and locations will experience secondary impacts by the UCPS construction and operations processes				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	The duration associated with impact on cultural heritage sites will be temporary, occurring only during construction, but there are culturally important sites that will be permanently impacted.				
Impact Extent	Local	Regional	Global		
	The level of impact will be local.				
Magnitude	No change	Slight	Low	Medium	High
	The magnitude of the impact occurs in areas used by PLN, especially in areas that will be inundated. The magnitude of the impact will also depend on the value of cultural objects which are usually irreplaceable even if relocation can be carried out				
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
	Depending on the cultural heritage sites or locations for ceremonies that can or cannot be moved, the receptor sensitivity is medium-high.				

Impact Severity	Slight	Low	Medium	High	Very High
	The combination of Medium Magnitude and Medium-High Receptor Sensitivity categorizes the impact severity as High.				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood/Inevitable
	These impacts are likely to occur during construction.				
Significance	Negligible	Minor	Moderate	Major	Critical
	The combination of medium likelihood and moderate severity will result in impacts of Major Significance.				

Mitigation:

1. The inundation process is carried out in accordance with the established SOP.
2. Conducting consultations with the community regarding culture around the project.
3. Intangible cultural heritage requires the preparation of a conservation plan for customary values.

10.3.6 Community Perceptions around the Project

The development activities of the Upper Cisokan Pumped Storage (UCPS) Hydropower plant have generated public perceptions regarding the impacts. The main problems or negative perceptions expressed by residents include the process of land acquisition, labor recruitment, compensation for community comfort, health, explosion disturbances, cracks in houses, absence of electricity, inappropriate SPPT value, and unpaid remaining land. This has the potential to trigger disruption from the community to the sustainability of the project.

In January 2013, PLN established a Complaint Handling Task Force to receive and resolve complaints related to land acquisition issues. Subsequently, the GTF Team was reassigned in June 2015, with a working period until May 2016. This assignment was in line with the commencement of the land acquisition process in the transmission road project area from August 2014. During this one-year working period (June 2015-May 2016), the Complaints Handling Task Force provided 3 channels for receiving complaints; through the TPA hotline number, direct visit (Basecamp/UPK/PMK), and through village facilitators.

After May 2016, the Complaints Handling Task Force assignment was no longer extended. As a result, from June 2016 to October 2018 (28 months), there were no records of complaints from the public. Records on complaint receipts and handling reappeared in November 2018. The party in charge was the Legal, Communication, and Land Affairs unit at UPP (Source: Recapitulation of Social Problems, updated July 2020). After that, in 2018, with the absence of the Complaint Handling Task Force, the community complaints process was directed to the village government for accommodation and subsequently accommodated at UPP (Legal, Communication and Land section).

The shift of the complaint channel to the Legal, Communications, and Land Affairs division has produced mixed messages that affected the flow of complaints handling from the public to PLN. This caused obstacles in the process of submitting complaints from the public. As a result, in October 2019 there was a demonstration in front of the UPP UCPS Office in Ciangkrong with the issues raised:

1. Settlement of construction impact-related cases.

2. Settlement of "remaining land" and "squeezed land" compensation payments.
3. Clarification of funds for economic recovery assistance

With these unresolved land issues, the matters have actually been delegated to the monitoring and evaluation team of West Bandung and Cianjur Districts concerning matters associated with land settlement-related compensation issues. From the interview with the team, work began in August. During the period of August - December 2019, the team had conducted measurement, inventory and verification of such lands that had not yet been compensated. In January-February 2020, it was reported to PT. PLN that a form of recommendation report that, among other things, contains recommendation to immediately settle compensation for the remaining and surrounded lands (private property). Even though the contract actually expired March 2020, the Monev Team is still working, especially to accommodate various complaints related to the construction of the UCPS project.

Based on information collected from heads of Cicadas and Sukaresmi Villages in 2020, community and village offices have difficulties in reporting/confirming land acquisition matters, CSR and infrastructure issues. Neither PT. PLN nor local government provided any clear solutions. The interviews with the land division of UIP PLAN also informed that, in principle, PLN is willing to solve the matters, however there is no institutional arrangement available nor any funding available, in particular for the 2020 budget.

Failure to resolve community grievances can negatively affect the project's performance to achieve its objectives. As such, an effective grievance redress mechanism is critical to respond to stakeholders' including community concerns and complaints. Impacts are summarized in Table 81.

Table 81. Impact Assessment on Public Social Disturbance around the Project

Impact	Public anxiety about the unclear complain mechanism				
Impact Nature	**Negative**	Positive	Neutral		
	The public anxiety that community felt will be negative impact				
Impact Type	**Direct**	Secondary	Indirect	Cumulative	Residual
	The impacts obtained are directly related to the project location and the surrounding community				
Impact Duration	Temporary	Short-term	**Long-term**	Permanent	
	The unresolved issues on the project will result in the restlessness of community during and after the project				
Impact Extent	**Local**	Regional	Global		
	Public anxiety only covers the vicinity of the UCPS project area and transmission lines				
Magnitude	No change	Slight	**Low**	Medium	High
	The magnitude of the impact that results in the restlessness of the community is low. The complaints are expected to occur when there is a discrepancy in the fulfilment of PLN's contract with the community.				
Receptor Sensitivity	Low	Low-Medium	Medium	**Medium-High**	High
	The affected community have medium-high sensitivity related to their anxiety about the project in their vicinity, especially when uncompensated payment is still an unresolved issue.				
Impact Severity	Slight	Low	**Medium**	High	Very High
	The combination of Low impact magnitude and Medium-High Receptor Sensitivity categorizes the impact severity as Medium				

Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood/Inevitable
	Interference or maybe demonstrations is very likely to occur during normal operating conditions if the issue is still unresolved. Demonstrations also took place in 2019.				
Significance	Negligible	Minor	Moderate	Major	Critical
	The combination of the Medium likelihood and the Medium Severity level will result in Minor-Moderate significance.				

Mitigation:

A grievance redress mechanism has been updated with a clear procedure and implementation arrangement. The project will establish a Grievance Unit to manage all grievances related to the project. Socialization on the GRM to the affected communities will be conducted as planned in the Stakeholder Engagement Plan.

10.3.7 Danger of Traffic Accidents

The old and new roads partly pass-through villages with houses, schools and economic businesses located close to the road. The safety of road users (pedestrians, motorcyclists and motorists) is a priority during the construction period, especially because of the heavy vehicles that will transport the quarry rock to the dam site. Other heavy traffic will transport machinery and equipment from outside Java Island. Another significant effect is traffic noise.

The structure and design of road user safety and noise mitigation are essential parts of the Access Road Construction Environmental Management Plan, which includes:

- Develop speed restrictions (signs, speed bumps) required at schools, villages, and intersections.
- Provide pathways for pedestrians, such as sidewalks and zebra crossings.
- Warning signs for all connecting roads, to alert traffic users that there are heavy vehicles on the access road.
- Provide noise suppression in schools and mosques.
- Ensures adequate road turns for heavy vehicles and increases visibility at turns and intersections by installing mirrors.

Traffic management will be a major part of the Construction Management Plan and the Workers' Barracks/Basecamp. Heavy vehicle traffic cannot be reduced but still managed. Management options include:

- Restrict construction vehicle traffic during the hours that children travel to and from school, and provide traffic management to direct traffic during these hours.
- Ban heavy vehicle traffic after dark.
- Large/heavy vehicles require an escort vehicle.
- Signs for access roads and displays safety signs along the road at fixed intervals.
- Outreach programs for students and the community.
- Inform the public about regular traffic movements.
- Driver outreach programs.
- Carry out complaint records and implementation plans.

Consideration of road design, heavy traffic restrictions and management, and extension programs, which will contribute to safer roads, minimizing potential risks to road users.

During the construction stage, traffic accidents can occur along the main road. The access road passes through the villages where houses, schools and economic enterprises are along the road.

A detailed assessment of the project's impact on traffic safety can be seen in Table 82.

Table 82. Traffic Safety Impact Assessment

Impact	Impact on traffic safety during construction				
Impact Nature	Negative	Positive	Neutral		
	Traffic safety impacts during construction will have a negative impact.				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	Traffic safety impacts during construction will have an immediate impact.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	The duration will be temporary because it relates to heavy vehicle traffic during construction.				
Impact Extent	Local	Regional	Global		
	The extent of the impact will be local, limited to the area of the main road.				
Magnitude	No change	Slight	Low	Medium	High
	The magnitude of the impact will be High if traffic management and the provision of control measures are inadequate.				
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
	The sensitivity of the receptors is Low-Medium because traffic signs have been installed including on crossings on the Access road. Management of entry and exit of heavy vehicles will be scheduled and controlled.				
Impact Severity	Slight	Low	Medium	High	Very High
	The combination of High Magnitude and Low-Medium receptor sensitivity categorizes the impact severity as High.				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood/Inevitable
	These events do not appear to have occurred at some time during construction and there has never been an accident on an access road.				
Significance	Negligible	Minor	Moderate	Major	Critical
	The combination of Low Likelihood and High Severity results in a Minor-Moderate significance.				

10.3.8 Economic Employment and Business Opportunities

The main advantage of the project is job opportunities and prospects for earning income through products and services. Employment opportunities for local people as manual laborers will increase sharply during construction. It is estimated that an additional 1500 workers will be required during the project; as many as two-thirds of manual labor positions are for local residents. Landowners and other residents in the project area have priority, especially for manual labor. The contractor will manage the workforce, and job vacancies will be announced at the contractor's office so that local people can apply to work.

There is a temporary increase in economic activity during the construction stage, with the need for services such as accommodation, shops, rental vehicles, and the supply of materials so the needs of the workers and their families could be met.

Both employment and business activities are expected to increase local people's income from the non-agricultural sector and have a substantial (short-term) effect on welfare and poverty reduction. The increase in family income is expected to increase the standard of living. There are also opportunities to learn and improve skills and expertise.

The potential risk is the distortion of workers in the home or on the farm, especially those not involved in construction.

Employment opportunities and opportunities for income through products and services will increase during construction.

Table 83. Impact Assessment on Employment and Business Opportunities

Impact	Impact on employment opportunities and economic business				
Nature of Impact	Negative	Positive	Neutral		
	The impact of employment opportunities and economic business will have be positive.				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	The impact on economic employment and business opportunities during construction in indirect.				
Duration of Impact	Temporary	Short-term	Long-term	Permanent	
	The duration will be short-term, limited to the construction period.				
Impact Range	Local	Regional	Global		
	The extent of the impact will be regional, within the UCPS construction area and the transmission line and the surrounding area.				
Magnitude	No changes	Slight	Low	Moderate	High
	The magnitude of the impact will be High because economic activity will take place				
Receptor Sensitivity	Low	Low-Moderate	Moderate	Medium-High	High
	The sensitivity of the receptors is low-moderate because the number of workers required is large enough for the acceleration of economic enterprises.				
Impact severity	Slight	Low	Moderate	High	Very high
	The combination of High Magnitude and Low-Medium receptor sensitivity categorizes the impact severity as High.				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood/Inevitable
	The probability of the impact is high.				
Significance	Negligible	Minor	Moderate	Major	Critical
	The combination of High Likelihood and High Severity causes the impact significance to be Major.				

10.3.9 Community Lifestyle, Health and Culture

There is a risk of community disruption and unrest due to the abundance of workers during the construction period. This usually occurs when customs and traditions or religion are ignored by migrant workers, or when relatively high paid workers live in low-income communities. Increase in crime and social harassment are also possible among the resident and migrant populations. The project construction activities, along with the influx of labor into the project area could have general public health and safety impacts upon the communities in the project areas. Local community members could be exposed during the construction phase to higher risks of STDs and other communicable diseases, as well as respiratory illness due to dust. Project traffic could also increase the risks of traffic accidents for local community members.

In a situation where there are many migrant workers who enter a community, it will increase health-related problems, especially those related to communicable disease. Both residents and workers are at risk of infection by new diseases.

Labor disruption like this is not common in Indonesia. Particularly when labor migrants are mostly Indonesian citizens who embrace the culture of the surrounding community. However, if there are foreigners who become part of the workforce, the introduction of cultural awareness programs and planned management can help assimilation and understanding between communities. The contractor will provide training on infectious diseases. Mitigation of potential labor impacts will be managed through the Construction Management Plan and the Workers' Barracks/Basecamp.

Table 84. Impact Assessment on Community Lifestyle, Health and Culture

Impact	Impact on lifestyle, health and culture due to the entry of migrant workers				
Nature of Impact	Negative	Positive	Neutral		
	Can have a negative impact if workers and labor camps are not properly managed and cultural awareness programs are not introduced.				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	Does not have a direct impact on society.				
Duration of Impact	Temporary	Short-term	Long-term	Permanent	
	The duration will be long term if the influence of workers is very large.				
Impact Range	Local	Regional	Global		
	The extent of the impact will be local and regional, not limited to the project area.				
Magnitude	No changes	Light	Low	Moderate	High
	The magnitude of the impact will be High if the workers are not well-managed.				
Receptor Sensitivity	Low	Low-Moderate	Moderate	Medium-High	High
	Receptor sensitivity is Low-moderate because the community already has a tradition and lifestyle that is rooted in society.				
Impact severity	Slight	Low	Moderate	High	Very high
	The combination of High Magnitude and Low-Moderate receptor sensitivity categorizes the impact severity as High.				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood/Inevitable
	The possibility of the affected community is low.				
Significance	Negligible	Minor	Moderate	Major	Critical
	The combination of Low Likelihood and High Severity has a Moderate significance.				

10.4 Occupational Health and Safety (OHS) Impacts during Construction Stage

The construction phase of the UCPS as a large and complex dam construction project will come with inherent hazards and high-risk work activities which must be managed through the establishment and implementation of an Occupational Health and Safety Management System with associated plans and procedures developed by the Contractors and approved by PLN and supervising engineers. The OHS system will be implemented in accordance with the provisions of the laws and regulations in Indonesia, which are in line with the International Labor Organization (ILO) requirements.

The OHS measures will be designed and implemented based on approaches and standards detailed in The World Bank Group EHS Guidelines Good Practice Note Environmental, Health and Safety Approaches for Hydropower Projects and other Good International Industry Practice for occupational health and safety. In accordance with ESS2 specifically, the OHS measures will be designed and implemented to address the following:

- Identification of potential hazards to project workers, particularly those that may be life-threatening.
- Provision of preventive and protective measures, including modification, substitution, or elimination of hazardous conditions or substances.
- Training of project workers and maintenance of training records.
- Documentation and reporting of occupational accidents, diseases, and incidents.
- Emergency prevention, preparedness and response arrangements to emergency situations established under ESS4.
- Remedies for adverse impacts, such as occupational injuries, deaths, disability, and disease. Such remedies should consider, as applicable, the wage level and age of the project worker, the degree of adverse impact, and the number and age of dependents concerned.

10.4.1 Discussion of Impacts

OHS hazards and risks are anticipated to arise from the construction activities and mobilization of construction workers under different Work Packages (WP). These activities include construction of Upper and Lower Dams and Waterways, Power house, Switch Yard, and Building Works (including operation of the Gunung Karang Quarry), 500 kV Transmission Line, Hydraulic Metal Works, and provision of Pump Turbine, Generator-Motor, and Auxiliary Equipment.

The most significant Occupational Health and Safety (OHS) hazards associated with hydropower projects occur during the construction phase and include activities with an extremely high risk for workers. The activities which carry an elevated risk of injury or fatality if not managed adequately are listed below:

- Working near water such as rivers and reservoirs.
- Working at heights, particularly during dam wall construction and transmission line construction and stringing.
- Working in confined spaces, for example, during tunneling.
- Working underground.

- Working with heavy machinery, particularly on steep and unstable slopes, tunnelling, on public roads, and in quarry.
- Working with explosives.
- Working on slopes and unstable ground.
- Working with low voltage and high voltage electricity.
- Using vehicles on public and project roads.
- Extended or elevated exposure to dust, noise, the sun, heat and wet weather.
- Working at night / shift work / fatigue / heat stress.
- Working with hazardous materials such as fuels, cement, and fly ash. Exposure to illnesses, communicable diseases, COVID-19 and others.
- Exposure to mental or physical harassment, SEA/SH, and injury from interpersonal conflicts.
- Exposure to floods, earthquakes, landslides and other natural disasters.

A number of factors will influence the construction project's success in managing these high severity risks. Firstly, supervision by the project owner (PLN) and its Supervision Engineer. Secondly, the experience and safety compliance and culture of the Contractor and its management of sub-contractors, and thirdly the level of training and skillset of the workforce. All parties who employ or engage project workers will develop and implement procedures to establish and maintain a safe working environment, including that workplaces, machinery, equipment, and processes under their control are safe and without risk to health, including by use of appropriate measures relating to chemical, physical, and biological substances and agents. Such parties will actively collaborate and consult with project workers in promoting understanding, and methods for, implementation of OHS requirements, as well as in providing information to project workers, training on occupational safety and health, and provision of personal protective equipment without expense to the project workers.

Each Contractor for each package will be expected to conduct a hazard and risk identification and create a risk register using the Hazard Identification, Risk Analysis, and Risk Control (HIRARC) method. The Risk Register will identify controls such as elimination, substitution, modification, and preventive and protective measures.

Project workers are likely to be exposed to the above identified risks over the estimated 5 years of construction. Workers with low experience of working on large scale construction project are expected to be more vulnerable as their skillsets, experience and understanding of health and safety will probably be limited compared to the skilled workers who will have worked on similar projects and have sufficient training.

Furthermore, the project site location has limited high quality healthcare facilities and is not conducive for providing a good response to moderate to serious accidents. Community health centers in the area are not adequate to deal with emergency first-aid response or more serious accidents and the closest well-equipped hospitals are located in Bandung which is over 2 hours away by road.

The Hierarchy of Controls pyramid will form the foundation by which safety risks and hazards are managed and controlled. The most effective measure is elimination/substitution, followed by engineering controls, administrative and work practice controls and finally PPE as the least effective at the bottom.

The controls are discussed below:

1. Elimination/substitution. The best way to deal with a safety hazard is to eliminate it altogether by preventing exposure to the hazard before it even occurs. In substitution, one seeks to permanently reduce the risk by substituting a less hazardous material or reduction of system energy. These are process design solutions that require a permanent change to how a job is performed.
2. Engineering controls. Change the structure of the work area to reduce exposure using safety devices or barriers. An example would be to place a high fence around a dangerous location to prevent access.
3. Administrative and work practice controls. Implement procedures that require workers to do things to reduce their exposure to a risk. A lockout/tagout program is an example of an administrative control. Set expectations that workers will engage in safe work practices. Another example is the use of warning signs, sirens and alarms.
4. Personal protective equipment (PPE). Make sure employees wear the proper protective clothing, gloves and eyeglasses for the job. Examples are safety goggles, respirators, fall protection and hearing protection.

10.4.2 Impact Evaluation and Significance

Worker health and safety across the Project must have a 'zero harm' goal and be managed carefully to ensure minimal accidents and no fatalities occur. The main area of concern during the construction relates to ensuring a high level of consistent compliance to health and safety behavior for the workers including the main Contractors and the subcontractors. In particular, local subcontractors and workers who are likely to have low familiarity of occupational health and safety hazards.

As such, it is anticipated the impact magnitude is high given the scale of exposure and duration of the project. The number and experience of workers (2000 or more) during the peak construction period and the high number and turnover of workers on the site for the duration of the project. Although many of the workers will be skilled, trained and experienced, there is a likelihood that local workers will have little or no experience in construction work and knowledge of safety. Workers (in particular those considered local) may be exposed to a number of construction injuries and fatalities risks, if not aware of the consequences the vulnerability is assessed as high for local workers resulting in an impact significance of high. Other vulnerable workers may be women and young people, who are more likely to suffer from workplace abuse, or be at risk from inappropriate sanitary or health facilities or from ill-fitting PPE. During construction there are increased safety risks and with potential for injuries and fatalities. All contractors are required to ensure that the Health, Safety, and Environmental (HSE) risks are identified for their direct employees and sub-contractors to safeguard the health and safety of the local workers who are likely to be less experienced in this area.

Each Contractor will develop an Occupational Health and Safety (OHS) Plan that will cover all of the hazards and risks identified using the Hazard Identification, Risk Analysis, and Risk Control (HIRARC) method. The resulting Risk Register will be regularly reviewed and maintained.

The OHS Plan should be based on applicable Indonesian Laws and Regulations, Good Practice Note Environmental, Health and Safety Approaches for Hydropower Projects, World Bank Group EHS Guidelines as well ESS 2 and will cover the following:

- Clearly delineate the scope of their control and responsibilities for worker health and safety, in terms of location(s) on site and activities within their control. This will be critical when there are multiple Contractors on site for various Packages.
- The Contractor will prioritize worker health and safety standards, such as preparing SOPs for each type of construction activity, conducting regular health and safety training and briefings (in the local languages) before the implementation of the activities and compulsory use of personal protective equipment (PPE). Appropriate, high quality and well-fitting PPE will be provided to all workers.
- The Contractors and Supervision Engineers must have sufficient staff and resources to manage health and safety, including qualified and trained staff, staff with adequate managerial authority to control hazards and risks, suitable budgets, appropriate equipment, controls and PPE and access to all Project areas to assess and supervise healthy and safe work practices. Worker standards to be aligned with national requirements and ESS2 requirements for health and safety during pre-construction and construction, along with inductions, training refreshers and inspections. Each individual will be personally assessed for competency and only allowed to work in areas where they have the required competency. On the job training and tracking of competency will be a continuous part of supervision of staff.
- Workplace processes will be put in place for project workers to report work situations that they believe are not safe or healthy, and to remove themselves from a work situation which they have reasonable justification to believe presents an imminent and serious danger to their life or health. Project workers who remove themselves from such situations will not be required to return to work until necessary remedial action to correct the situation has been taken. Project workers will not be retaliated against or otherwise subject to reprisal or negative action for such reporting or removal.
- Project workers will be provided with facilities appropriate to the circumstances of their work, including accommodation, access to canteens, access to clean drinking water, hygiene facilities, and appropriate areas for rest. Where accommodation services are provided to project workers, policies will be put in place and implemented on the management and quality of accommodation to protect and promote the health, safety, and well-being of the project workers, and to provide access to or provision of services that accommodate their physical, social, and cultural needs.
- The Contractors will develop and widely communicate and enforce its "Golden Health and Safety Rules" and create a safety culture.
- Strict Occupational Health and Safety requirements will be embedded in the Bid Documents Contractor's contract as per the World Bank Standard Procurement Documents, to ensure risk management, occupational injuries, worker rights, deaths, disability and diseases are managed as per the ESMP, ESS2 and GIIP.
- The Supervision Engineer and Contractor will undertake their own daily audits with H&S inspectors responsible for monitoring behaviors and correcting where required.
- Should non-compliance repeatedly occur a zero-tolerance approach will be adopted by PLN and enforced on the Contractor by the Supervision Engineer.
- A system for regular review of occupational safety and health performance and the working environment will be put in place and include identification of safety and health hazards and risks, implementation of effective methods for responding to identified hazards and risks, setting priorities for taking action, and evaluation of results.
- Detailed records of near misses and incidents must be kept and used for investigations and for continuous improvement purposes.

- Each Contractor will establish and implement a Worker Grievance Mechanism that will be accessible for all workers and sub-contractors to report issues (a confidential option should be provided). When complaints are submitted, the Contractor will undertake an immediate investigation. The Supervision Engineer will oversee the Grievance Mechanism and support the resolution where required.
- Emergency response and incident management procedures with prevention and early warning procedures, preparation, response and recovery from emergencies, including natural disasters, disease outbreaks, conflict or social unrest, pollution incidents and injury and fatality incident management.

Table 85. Impact Assessment High Risk Construction Activities

Impact	The impact on workers is illness, injury, or fatality from high-risk construction activities (working at height, near water, in confined spaces, with explosives, near heavy machinery, on slopes/unstable ground, exposure to sun/heat/wet weather, hazardous materials, with electricity, and exposure to illnesses communicable diseases such as COVID-19)				
Nature of Impact	Negative	Positive	Neutral		
	The potential impact on workers conducting high risk activities or activities in high-risk environments is illness, injury or fatality.				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	Workers are directly exposed to hazards and will be directly impacted by illness, injury or fatality. Their families will be indirectly impacted.				
Exposure to risk and duration of Impact	Temporary	Short-term	Long-term	Permanent	
	The exposure to risk will be short term as the hazards will exist during the entire 4-5 year construction phase. The impact (illness, injury, death) will be permanent.				
Exposure to Risk	Local	Regional	Global		
	The exposure of risk will be limited to workers in the project work area. These workers may be local or regional workers, or may be foreign workers.				
Magnitude	No changes	Slight	Low	Moderate	High
	Has the potential to impact tens to hundreds of workers.				
Receptor Sensitivity	Low	Low-Moderate	Moderate	Medium-High	High
	All workers are vulnerable to hazards, but local people with little experience or formal training on construction sites and health and safety may be more vulnerable. Women and youth working on the site may be more vulnerable to health risks, abuse and protection from hazards.				
Impact severity	Slight	Low	Moderate	High	Very high
	The combination of High Magnitude and High Receptor Sensitivity the impact severity is deemed Very High				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood/Inevitable
	Large hydropower dam construction projects comprising large workforce many with low skills have a high incidence of accidents and fatalities. The duration of the project is four to five years, increasing the exposure risk to the workforce.				
Significance	Negligible	Minor	Moderate	Major	Critical
	The combination of Very High Severity and High Likelihood leads to critical significance for the construction phase of the project. To manage the risk health and safety must be prioritized by the PLN, Supervision Engineer and the Contractors and with proper implementation, regular monitoring and improvement of the mitigation measures.				

CHAPTER 11. ENVIRONMENTAL AND SOCIO-ECONOMIC IMPACTS – IMPOUNDMENT STAGE

11.1 Introduction

The inundation process is carried out to fill water in the upper and lower dam reservoirs. Although the inundation phase is a small part of the overall project, there are potential impacts on hydrology, habitat and river biodiversity, use of downstream streams, river access and community connectivity. This is discussed in this section, as part of operational impacts.

11.2 Environmental Impact of the Inundation Phase

11.2.1 Changes in River Flow

The inundation phase is the period of time when the reservoirs are filled and commissioned. Hydrology impacts during inundation are assessed separately from the operational phase because the hydrological regimes are different. Inundation will occur during the wet season (December to May), to minimize the risk that the rivers will be at low flow conditions. The inundation process and water requirements are detailed in Section 4 and summarized here.

The dead storage area of the upper reservoir and the dead and active storage areas of the lower reservoir will fill during the inundation phase. The total amount of water required is as follows (Table 86).

Table 86. Storage volumes of upper and lower dams

Reservoir	Dead Storage volume (m^3)	Active Storage volume (m^3)	Total volume required for filling (m^3)
Upper, on Cirumamis	530,000	0	530,000
Lower, on Cisokan	51,500,000	11,500,000	63,000,000
Total	52,030,000	11,500,000	63,530,000

Cirumamis Waterfalls:

Prior to inundation, the diversion infrastructure will be blocked and removed. The reservoir will start to fill behind the dam. The bottom outlet will discharge all inflow. No variation in flow will be experienced downstream of the upper dam in the Cirumamis River during this phase.

Water will be pumped from the lower dam to the upper dam to fill the dead storage in the reservoir during the inundation period and / or during commissioning. During the commissioning stage, the active storage will be filled by pumping water from the lower reservoir and released back to the lower reservoir through the power generation plant.

In emergencies during this phase, the bottom outlet of the upper dam can be adjusted to allow a maximum discharge of 0.96 m^3/s.

Cisokan River:

Prior to inundation, the diversion tunnel will be permanently closed. The lower reservoir will start to fill with flow from the Cisokan River. The filling is proposed to take at least four months (122 days) based on a maximum fill rate of 6.21m^3/s and the calculations of average river flow over the wet season (the water balance is provided in Section 4) (Table 87). On an average monthly flow basis, the intake of water and the downstream releases are represented in table 102a. This indicates what releases would occur during average flow. In reality, the downstream flow will increase and decrease with the natural river flow.

Table 87. Representation of average downstream e-flow releases during inundation during the wet season

	Dec	Jan	Feb	Mar	Apr	May
Average m^3/s	20.76	15.82	24.05	25.45	27.20	18.10
UCPS intake m3/s	6.21	6.21	6.21	6.21	6.21	6.21
Downstream e-flow release	14.55	9.61	14.24	19.24	20.99	11.89

Using January average monthly flows as an example of the lowest average flow release downstream, this flow is equivalent to the median annual flow (refer Table x). For average and above river flow conditions during the wet season, there is little impact on downstream flow. This is because the flow is within the normal wet season range and will increase and decrease in the normal flow patterns.

If there are drier periods in the wet season then the rate of intake will reduce accordingly, to allow for sufficient e-flow in the river for irrigation and ecological purposes. The minimum permitted e-flow for UCPS lower dam under the Indonesian regulatory framework is 0.55 m^3/s. However, since this is equivalent to 30% of the Q97 flow, it is unlikely to be naturally experienced during the wet season. Due to the short inundation period, it is not necessary to stress the river to this extent. A proposed discharge flow regime is provided in the table below.

Table 88. Proposed regime for inflow and outflow during inundation

Scenario	High flow, average flow, moderately low flow	Moderately low flow to Q97	Q97 – Q 100
Natural inflow m^3/s	>= 7.91	7.91 >< 1.97	<=1.70
Intake for UCPS Scheme m^3/s	6.21	6.21 >< 0 (Inflow - 1.70)	0
Residual flow discharge downstream lower dam m^3/s	>= 1.70 (Inflow – intake)	1.70	1.70

The only sensitive downstream receptor is the Cihea Irrigation Scheme. There is an opportunity to adjust downstream flow during periods to ensure that there is enough water for the Cihea Irrigation Scheme to meet their requirements. There is an opportunity to adjust downstream flow during periods to ensure that there is enough water to meet the requirements of the Cihea Irrigation Scheme. This will take coordination with the Irrigation Scheme operators, and a regime agreed upon between parties. The agreed regime will be documented in the Reservoir Filling Plan and Operational Environmental Management Plan. Filling will take more time if the flow of the river reduces to less than 7.91 m^3/s and / or more water is released for the irrigation scheme needs.

In case of emergencies during inundation, the operational emergency procedures will be initiated. The bottom outlet allows for maximum discharge of 42.5 m^3/s.

The impact assessment of the changes in flow of the Cisokan River and Cirumamis River at the inundation stage of the UCPS dam is shown Table 89.

Table 89. Impact Assessment of Cisokan and Cirumamis River Flow During the Inundation Stage

Impact	Changes to the natural flow regime in the Cisokan River.				
Impact Nature	Negative	Negative	Negative	Negative	
	There will be an impact of UCPS operation by reducing the flow in the Cisokan River by <6.21 m^3/s to fill the two reservoirs. The flow downstream in the Cirumamis River will be maintained at the rate of inflow at all times. There will be no change to the volume and rate of flow in the waterfalls in the Cirumamis River.				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	Changes in flow patterns in the downstream of Cisokan River are a direct impact of the UCPS activities.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	Changes in the flow regime in the Cisokan and Cirumamis Rivers will take place during four consecutive months over one year, during the wet season.				
Impact Extent	Local	Regional	Global		
	Changes in the flow regime in the Cisokan Rivers may impact the total water available to the Cihea Irrigation Scheme, which is about 3 km below the lower dam.				
Impact Magnitude	No change	Slight	Low	Medium	High
	The main component of the impact is how the discharge in the Cisokan and Cirumamis rivers should be maintained for the Cihea scheme. The water balance shows that during average flow and above there will be no impact on water availability, however there may be impact during dry periods which would reduce the amount of water available for irrigation.				
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
	The Cihea Irrigation Scheme users are sensitive since there are a large number of households who rely on the water for income and livelihoods and would be anxious about any reduction in water availability. Rice growing is a significant contribution to the local economy. The aquatic ecosystem is not sensitive to the small to medium changes in flow during the wet season. The species are highly adaptable to diurnal and seasonal changes in flow.				
Impact Severity	Slight	Low	Medium	High	Very High
	Impact magnitude low and receptor sensitivity medium shows the impact severity as a medium.				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood/Inevitable

Significance	Change of flow will occur due to the need to fill the reservoirs, however the severity of the changes will depend on the river flow during the wet season. Average to high flows throughout the season will lead to low likelihood of impact. A 'dry' wet season will lead to an increased likelihood of impact.				
	Negligible	Minor	Moderate	Major	Critical
	Impact severity medium, with medium likelihood, give a minor-moderate significance result				

11.2.2 Changes in River Habitat and Biodiversity

The inundation of the riverbed will have direct impacts on river habitat and biodiversity and is discussed in detail of the operational phase below. The impacts of damming the river flow and taking up to 6.21m3/s for up to four months in the wet season will have secondary impacts on habitat and biodiversity:

• Reducing the availability of water habitats for biodiversity.

The water availability in Cirumamis River will be maintained, thereby maintaining the habitat in waterfalls, and steep and swiftly flowing river regions. The water availability downstream of the lower dam in the Cisokan River will reduce during inundation. The UCPS will take up to 6.21 m^3/s of water discharge for filling the reservoir and will release the rest. The reduction in wetted area, and depth of the Cisokan River, will have a minor impact on available river and riparian habitat, but area will remain within the normal range that the river experiences. No species have been identified that are sensitive to reduced flow or wetted area. There are no migratory species sensitive to changes in seasonal flow and all identified species are adaptable to changing river flow, velocity, wetted area etc.

• Creating an environment that supports the growth of algae in river bodies.

Flow reduction leads to reduced water depth and velocity, potentially creating the environment that supports the growth of algae and invasive species in the river bodies. The passing of all inflow except for up to 6.21 m^3/s for a short duration over the wet season will limit the likelihood of this occurring in the river downstream. The impact risk is further minimized by the natural increase and decrease of flow that will be discharged below the dam in response to rainfall.

• Reduces the river's ability to transport sediment and impairs algae growth on river banks.

Reducing the river flow regime can reduce the energy in the river to transport sediment. This can lead to deposition of fine sediments and reduce the energy required to scour off algae and plant growth. This impact is neutralized by the dam structure which will reduce the sediment load in the discharge, and thereby create more energy in the water to transport sediments. The impact on sediment transport, deposition and erosion is discussed in the operational phase section.

• Changing the natural triggers of the rainy season for fish to start migrating or laying eggs. This can reduce fish breeding.

Based on baseline river habitat data, the types of fish found in the rivers include Hampala, Benteur, Tilapia, Bogo, Lele and others which have the characteristics of being able to live in various habitats with the ability to adapt to various types of river flow, so that disturbance to fish life is not significant. There are no sensitive fish species which will be affected by flow changes in the wet season.

The impact assessment of habitat change and biodiversity in the Cisokan and Cirumamis rivers during the inundation stage is shown Table 90.

Table 90. Impact Assessment of Habitat Change and Biodiversity in the Cisokan and Cirumamis Rivers during the Inundation Phase

Impact	Changes in river habitat and biodiversity due to damming of river flow and filling of reservoirs.				
Impact Nature	Negative	Positive	Neutral		
	The impact of the inundation process is a negative impact because it may change the water habitat in the Cisokan River for biodiversity by reducing the wetted area, water depth and velocity as well as flow. It may reduce the ability to dilute or process pollutant concentrations in downstream areas. The Cirumamis River flow will not be modified.				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	The impacts that occur during inundation on river habitat and changes to flow patterns are direct impacts.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	The duration of the initial impact will last during the inundation process, but impacts are permanent.				
Impact Extent	Local	Regional	Global		
	Within the Cisokan River for 2-3 kilometres downstream to the next significant river confluence. Impacts will dissipate over this stretch as the river receives more inflow.				
Impact Magnitude	No change	Slight	Low	Medium	High
	The impact magnitude is classified as low because changes occur in the downstream areas in the Cisokan River and will be small in scale due to the small intake and short duration, compared to the natural flow during the wet season.				
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
	Receptor sensitivity is classified as medium because most of the flora and fauna in the Cisokan river area have high adaptability to flow changes, although some terrestrial species habitats will be lost. No migratory species have so far been identified that could be sensitive to changes in seasonal flow.				
Impact Severity	Slight	Low	Medium	High	Very High
	Low impact magnitude and medium receptor sensitivity show medium impact severity.				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood / Inevitable
	This impact is highly likely to occur during the inundation process.				
Significance	Negligible	Minor	Moderate	Major	Critical
	The medium impact severity of high likelihood leads to Moderate Significance				

The impact assessment results showed a Moderate value. This is mostly due to the medium sensitivity of the river and forest habitats. Longer term impacts on river habitat and biodiversity are discussed in the operational.

11.2.3 Erosion and sedimentation in Upper and Lower dams

The inundation process is the addition of weir water that has been formed from water sources that flow from the DTA. The inundation process causes an increase in the weir water level, which can cause a decrease in the binding power between soil particles, thereby increasing the likelihood of the soil to be washed away when a change in surface water level occurs. The results of the identification and measurement of rocks and the geology of the weir slopes show that there are rocks from weathering on the main rock which is quite compact. The difference in rock density causes rockslide lines to appear, which can lead to erosion-sedimentation and soil movement. Inundation causes an increase in water content, this will reduce the cohesion of soil particles as a result. The soil has the risk of being transported by water flow when it recedes. The relationship between water content and soil cohesion is presented in Figure 110.

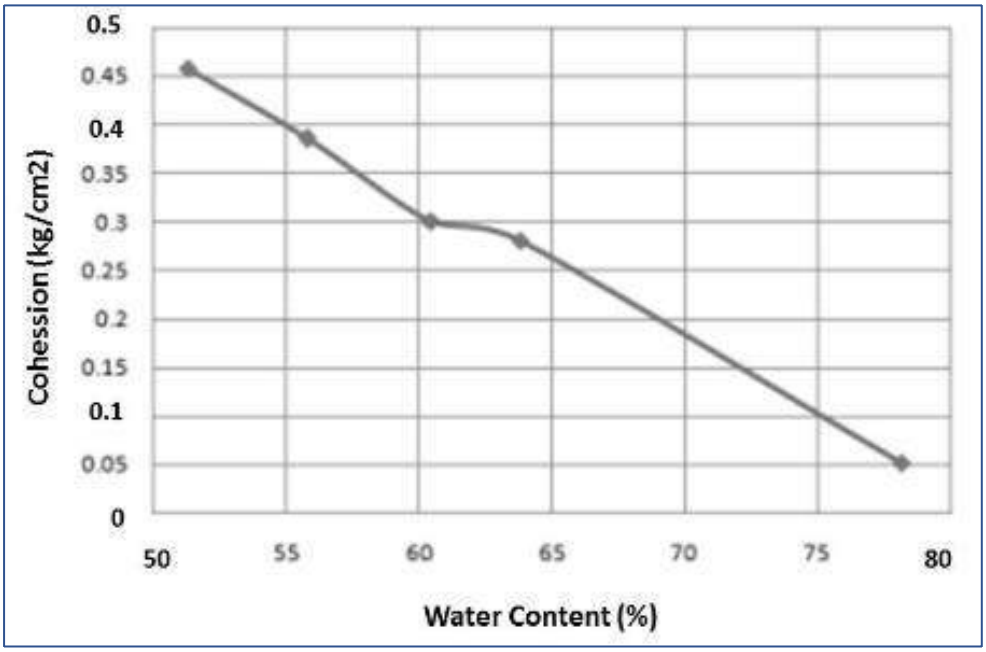

Figure 110. Increased Draw-Down Erosion Rate

Based on these conditions, the assessment of the impact of draw-down erosion on the upper and lower dams at the inundation stage is shown in Table 91.

Table 91. Assessment of the Draw-Down Erosion-Sedimentation Impact of the Upper and Lower Dams during the Inundation Phase

Impact	The potential for erosion on the upper and lower dam reservoir slopes due to inundation activities due to decreased soil cohesion.				
Impact Nature	Negative	Positive	Neutral		
	Soil cohesion decreases with increasing water content, so flooding will increase erosion even though it is small because the process is an increase in water content with a relatively slow water flow				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	The impact that occurs during inundation is the subsidence of the land surface in the receding area due to the dynamics of water.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	Imposing activity requires time, which slowly decreases the cohesion power between the soil surface grains which can cause erosion.				
Impact Extent	Local	Regional	Global		
	Erosion occurs only at low tide and its impact causes increased sedimentation in the weir body				

Impact Magnitude	No change	Slight	Low	Medium	High
	The magnitude of the impact that occurs on unstable soil surfaces in the upper and lower dam inundation areas is of medium level.				
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
	Receptor sensitivity is of low value because the impact does not have a major impact on humans. Effect of the impact on the amount of sedimentation is likely limited to the dam body.				
Impact Severity	Slight	Low	Medium	High	Very High
	Medium impact magnitude and low receptor sensitivity indicate low impact severity.				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood / Inevitable
	The possibility of draw down erosion during inundation is inevitable.				
Significance	Negligible	Minor	Moderate	Major	Critical
	The low impact severity and high likelihood leads to Minor Significance.				

The impact of draw-down sedimentation erosion is negligible-minor, indicating that there is an impact but it is not significant.

11.2.4 Reduced Vegetation and Loss of Habitat

The inundation area is 121.06 ha in the upper dam and 245.52 ha in the part of the lower dam that is still forested, which will add to the pressure on the remaining forest patches. This will result in the loss of forest areas in the wider landscape. Inundation can also indirectly impact biodiversity if it affects fruit-producing crops that provide food for a wide variety of animals. A further impact is forest fragmentation, which results in inhibition of the movement of wildlife as well as increasing edge effects and causing micro-climate change in the remaining forests.

Currently, habitat loss and fragmentation mitigation are carried out through revegetation activities. Before revegetating, PT. PLN (Persero) conducted a survey and delineated working zone 1 (BIA), 2 (corridor), and 3 (buffer zone) at the pre-construction stage. The results of these activities were then overlaid with the results of a ground check, carried out together with Perum Perhutani, to find out the forest plot numbers included in the working zone and put into the Forest Conservation Management Plan (RPKH), Perum Perhutani's annual program, and last integrated in the Operation Plan with PT. PLN (Persero) and Perum Perhutani. The results of delineation and overlay show that the area of all working zones within the revegetation area is 1,984.92 ha, where working zone 1 is 343.28 ha, working zone 2 is 248.58 ha, and working zone 3 is 1,393.06 ha.

In addition, PT. PLN (Persero) has also carried out revegetation with perennial plants on the access road from km 13 to km 22, especially along roads that are prone to landslides. Additionally, from km 22 to km 25 shrubs and trees which are native to the area were planted. This planting is done not only to improve habitat function, but also to maintain the stability of sloping land so that landslides do not occur. Plant types are adjusted to the plant recommendations in the BMP document.

Planting activities (revegetation) have also been carried out in other areas, including those near residential areas. Planting has been carried out three times from 2016 to 2019, which was the implementation of the PKS between PT. PLN (Persero) and Perum Perhutani. It should also be noted that the planting was followed by embroidery, in 2016 (1-time embroidery in 2017) and 2017 (1-time embroidery in 2018). The types planted are quite varied with the following details:

1. Planting in 2016 and 2017 consists of 3 categories of plants, namely:

   a. Staple Plant (pine)
   b. Filling Plant (rubber)
   c. Edge plants (suren and maesopsis)

2. Planting in 2019 the types of plants have changed slightly, namely:

   a. Staple Plant (pine)
   b. Periphery crops (suren and fruits, fruit types based on PRA results with the community around the project site)

From 2016 to 2018, planting was carried out on an area of 281.62 ha, with 635,708 staple plants, 145,875 fillers, and 132,610 perennials. The rest will be carried out in 2019. From a financial perspective, planting or revegetation during that time period costs a total of Rp 7,063,324,671. PT. PLN (Persero) has created and manages its own nursery in an office area in Cisokan (UPP Cisokan). PT. PLN (Persero) has collaborated with the community in making nurseries in several places as a form of CSR from PT. PLN (Persero) towards the community around Cisokan. However, the plants maintained there are only for small-scale revegetation activities, such as office areas and landslide prone points in the project area, but do not supply the revegetation contract between PT. PLN (Persero) and Perum Perhutani.

Revegetation and reforestation activities have increased the area of vegetation cover in working zones 1, 2, and 3. However, these activities cannot be evaluated for their effectiveness in improving the quality of wildlife habitat because vegetation cover has not improved the connectivity of wildlife habitat. Species have been selected that take into account the benefits to the local community and can increase the value obtained by the community from efforts to increase vegetation cover. However, the effectiveness of this benefit principle cannot be evaluated considering the plants have not yet produced yields.

A visual analysis of land cover changes from the 2016 and 2019 land cover maps shows the dynamics of changes occurring in the landscape area of the Cisokan Hydroelectric Plan. In 2016, open land was dominant in the northern and eastern regions of the Cisokan River, as a result of the construction of the access road. In 2019, after the construction of the access road was completed, the population began to use the area as a *huma* or *talun*. In calculating the total area of each land cover type in 2016 and 2019, some changes were observed over the three-year period (Table 92). In general, mixed gardens and agroforestry (*talun*) and dry field (*huma*) are the two dominant land covers in the UCPS hydropower area. The land cover composition of both covered about 83% in both 2016 and 2019. In the 2016-2019 period, the number of mixed plantations lost was 606 ha, with an increase of 424 ha. Thus, the total change in mixed garden at the landscape scale is -182 ha, or 0.05%. The next land cover that underwent the most changes was dry fields (*huma*), with a loss of 335 ha, a gain of 430 ha, and a total net change of 95 ha.

The areas that are in the Working Zones have relatively more balanced patterns of change. The value of the G / L ratio for open land, dry fields and mixed gardens/agroforestry is close to 1, indicating the dynamics of land cover from a balanced use pattern. For areas outside the Working Zones, the G / L ratio for mixed gardens is below 0.5 and the G / L ratio for open land and dry fields is above 1.5. This indicates the rapid rate of change of mixed gardens (*talun*) into dry fields (*huma*).

Table 92. Landcover Gain/Loss Ratios and Net Change from 2016 to 2019

	In				Out			Net
	L	G	G/L	Net	L	G	G/L	
Open Land	109	114	1.05	5	60	90	1.50	30
Dry Field	248	263	1.06	15	87	167	1.92	79
Mixed Garden/agroforestry	345	300	**0.87**	**-45**	261	125	**0.48**	**-136**

Description: L = *losses*, G = *gain*, Net = *net change*

Regarding the perspective of preserving biodiversity in the UCPS Area, the planned offsetting strategy should be able to maintain the diversity of flora and fauna. However, the results of the impact analysis of inundation and changes in land use patterns indicate the possibility of higher pressure for the animals in BIA 8 (Leuweung Gowek) and BIA 12. Areas in the middle and northeast range, BIA 1,2,3, 5,6,7, 9 and 10, will face pressure from increasing agricultural activities, by utilizing open land. The relative BIAs based on this analysis are BIA 13, 14 and 15. It is, therefore, still necessary to carry out conservation efforts in certain areas, especially if the inundation phase starts based on an analysis of patterns of possible land cover change, and its integration with information on biodiversity and social activities.

Table 93. Impact Assessment of Reduced Vegetation and Loss of Habitat

Impact	Reduced vegetation and loss of habitat				
Impact Nature	Negative	Positive	Neutral		
	Decrease in function and fragmentation of animal habitats, loss of food sources for wildlife, which become obstacles to movement of wildlife and undermine metapopulation viability and ultimately species survival				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	Inundation will cover an area of 105 ha on the upper and 357 ha in the lower. Parts of important biodiversity areas will be flooded reducing available forest habitat to Critical Habitat trigger species.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	Inundation is permanent				
Impact Extent	Local	Regional	Global		
	The impact occurs on the inundation area				
Impact Magnitude	No change	Slight	Low	Medium	High
	The magnitude of the impact identified from the inundated area, namely 105 ha in the upper dam and 357 ha in the lower dam areas is medium.				
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
	The vegetation type in the inundation area is mostly production forest dominated by cultivated vegetation, only a small portion of natural vegetation remains but some of these areas still harbour Threatened species such as Javan Gibbon and Slow Loris that use these habitats for feeding or for dispersing between forest patches.				
Impact Severity	Slight	Low	Medium	High	Very High
	Medium impact magnitude and Medium-High receptor sensitivity show High impact severity.				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood / Inevitable
	Inundation is part of the project activity, so its impact is difficult to avoid				

Significance	Negligible	Minor	Moderate	Major	Critical
	The high impact severity with high likelihood leads to Major Significance				

11.2.5 Habitat Fragmentation and Barriers

Inundation activities in an area of 121.6 ha on the upper dam and 245.52 ha in the lower dam can cause fragmentation which, in turn, results in habitat gaps. Habitat gaps will cause disturbance to the movement of various animals and their home ranges. The narrowing of the home range will interfere with the survival of various wildlife. As a result of the inundation of habitats on the edge of the weir, forest vegetation communities, shrubs and *talun* will change to form a buffer zone area. Inundation will also cause a part of the habitat to be cut off (habitat gap), causing the prey to move to other places including cultivated areas. The large amount of open land makes predatory wildlife easier to see and eventually hunt down.

In order to control fragmentation and loss of habitat, PT. PLN (Persero), in collaboration with *Perum Perhutani*, has made various efforts such as revegetating non-forest areas and reforestation. This activity involves the local community. Revegetation, with high growth success through the embroidery process, has increased vegetation cover and has the potential to reduce habitat loss due to forest encroachment and tree felling. However, the effectiveness of this revegetation activity has not been thoroughly evaluated since the activity has only been in practice for less than five years, and is yet to show significant improvements to habitat quality, for example in terms of increasing habitat connectivity.

PT. PLN (Persero) has also created artificial corridors in several BIAs to meet the needs of animal crossing habitats fragmented by the construction of access roads, both in the form of canopy bridges at BIA 4, 5, and 6, and animal culverts at BIA 1 and 6. The rope bridge specifications are in line with the guidelines from Appendices in the BMP. Meanwhile, the animal culvert is primarily intended as a water channel but can double as an animal crossing. Additional rope bridges across the narrowest parts of the dam or rivers will be considered for increasing the connectivity between forest areas separated by water.

The initial stage of reforestation activities has been carried out well in the form of procurement of seeds, determining the location of reforestation, and planting seeds. However, not all plant species recommended in the BMP action plan are planted by *Perum Perhutani*. This can reduce the effectiveness of reforestation in improving the quality of animal habitat as well as providing benefits to local communities.

Table 94. Habitat Fragmentation and Barrier Impact Assessment

Impact	Habitat fragmentation / habitat barrier during the inundation stage. Crossable rivers will become uncrossable dam areas adding to fragmentation impacts for terrestrial species.				
Impact Nature	Negative	Positive	Neutral		
	Habitat fragmentation can hamper animal dispersal and reduce the area through which individual animals can range				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	Inundation causes the habitat to become fragmented, forming a gap / barrier habitat				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	Gap / barrier in habitat caused by permanent inundation				

Impact Extent	Local	Regional	Global		
	Habitat is fragmented around the inundation area				
Impact Magnitude	No change	Slight	Low	Medium	High
	Land fragmentation due to inundation, causing a gap / barrier will disrupt the movement and home range of wildlife				
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
	Habitat fragmentation causes a reduction in home range which will disrupt the survival of various wildlife in the inundation area				
Impact Severity	Slight	Low	Medium	High	Very High
	The impact magnitude medium and medium-high receptor sensitivity show high impact severity.				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood / Inevitable
	Land clearing and inundation are part of the project activity, so the impact cannot be avoided.				
Significance	Negligible	Minor	Moderate	Major	Critical
	The impact severity of high, with high likelihood, leads to Major Significance.				

11.2.6 Population Decline and Threats to Protected Wildlife

The decline of wildlife populations due to inundation can be caused by damage and shrinkage of vegetation, narrowing of the home range and the presence of habitat gaps, thereby increasing the encounters between humans and wildlife. Damage and loss of vegetation due to inundation can cause potential places such as shelters, feeding ground, and reproduction sites to also disappear.

Regarding the 2009-2020 animal distribution map in the BMP report, it can be identified that the inundation process only affects the habitat of a few priority animals. It can be seen from the map that the inundation area will cover the habitat for the Javanese porcupines (*Hystrix javanica*) in grids B5 and C5. This condition allows the Javan porcupines to move to its nearest habitat, in grid C4, which has previously been identified as the habitat of the Javan porcupines. Inundation areas on Grid C4, E3, G2, and J3 were identified as covering habitat for slow lorises (*Nycticebus javanicus*), however, slow lorises have a home range of 5.58 to 5.44 ha so they can move to other areas that are their closest habitat. We can see that the habitat for the nearest slow loris is also found in areas BIA 14, BIA 13, near BIA 5 and BIA 2 so that if there is disturbance of inundation, slow loris can move to the nearest habitat, namely from grid C4 to D4, E3 to D3, G2 to BIA 5, and J2 to BIA 2. Meanwhile, inundation on grids E2, F2, and G2 around BIA 8, BIA 12, BIA 6 and BIA 7 were identified to cover the area where the Javan leopard was found (*Panthera pardus*). Leopards live in a home range or territory of about 5-15 km^2, this allows *Panthera pardus* to roam to find its territory so that inundation is identified as a low-medium impact to receptor sensitivity.

Table 95. Impact Assessment of Population Decline and Threats to Protected Wildlife

Impact	Population Decline and Threats to Protected Wildlife				
Impact Nature	Negative	Positive	Neutral		
	The decline in population as well as threats to protected animals, has the risk of causing an imbalance in the ecosystem and increasing human encounters with wildlife				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual

	Damage / shrinkage of vegetation, narrowing of the home range, habitat fragmentation				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	The impact on wildlife populations caused by the loss of vegetation will be long-term. Inundation activities will reduce the terrestrial habitat, while the area around it is a cultivated area that lacks potential as wildlife habitat. Without mitigation, populations of various species of animals in the area will shrink and there is a potential for local extinctions.				
Impact Extent	Local	Regional	Global		
	Impact occurs around the inundation area				
Impact Magnitude	No change	Slight	Low	Medium	High
	This decline in population and threats to wildlife will have a medium impact, because wildlife will has some ability to move to nearby areas that have similar habitats.				
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
	Inundation activities will reduce the terrestrial habitat, especially of forest-dependent species, while the area around it is a cultivated area that lacks potential as a habitat.				
Impact Severity	Slight	Low	Medium	High	Very High
	Medium impact magnitude and medium-high receptor sensitivity indicates high impact severity.				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood / Inevitable
	The impacts cannot be avoided, although they can be mitigated and offset by effective reforestation.				
Significance	Negligible	Minor	Moderate	Major	Critical
	The High impact severity with High likelihood leads to Major Significance.				

11.2.7 Disturbance to the Movement of Birds on the Transmission Line

At the inundation stage, the transmission line already has the potential to disrupt bird migration. Section 10.2.9.6 describes the specific collision and electrocution risks for migratory and resident species, especially larger bird species.

Table 96. Interference Impact Assessment on the movement of birds on the Transmission Line

Impact	Disruption of bird movement				
Impact Nature	Negative	Positive	Neutral		
	Electrocution, collision and forest habitat loss and fragmentation				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	The transmission lines are a risk to larger bird species, and certain mammals and reptiles. Land clearing for transmission line development will fragment forests.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	Electrocution and collision provide permanent risks during bird migration, especially from September to January, and year-round for other large resident species				
Impact Extent	Local	Regional	Global		
	Around the area of the transmission line				
Impact Magnitude	No change	Slight	Low	Medium	High
	Some larger bird species sensitive to electrocution and collision are already in decline and further mortality adds pressure on them				
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
	For some species this is significant cause of mortality				

Impact Severity	Slight	Low	Medium	High	Very High
	Low impact magnitude and low receptor sensitivity indicate low impact severity.				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood / Inevitable
	Electrocution and collision impacts have not been studied in Indonesia but are a considerable risk to large birds and other species elsewhere in the world. Follow up studies in Indonesia are needed to better understand likelihood and severity of impacts.				
Significance	Negligible	Minor	Moderate	Major	Critical
	The impact severity of high with medium likelihood leads to Major Significance				

11.3 Social Impact of the Inundation Stage

11.3.1 Downstream Users of the Cisokan River

There are many river users who depend on the Cisokan River for personal hygiene, washing, recreational fishing, and agricultural irrigation. The people along the Cihea irrigation route use this water as the main water source for agriculture.

The communities in Salamnunggal, Cikondang, and Panyusuhan mainly use the river as a source of water for personal hygiene, washing, and recreational fishing. Water from the Cisokan river is rarely used as a drinking water, they prefer to use well water. These users may not need a large volume of water, but their access to water will be affected, even more so if the water supply in the river dries up. The location of Salamnunggal village, Cikondang village, and Panyusuhan village are higher than the river so the people cannot use it as irrigation water.

The communities who use the river as a water source for agriculture are the people along the Cihea irrigation route. The Cisokan River will receive water input from the Cikondang River after Salamnunggal village, Cikondang village, and Panyusuhan village. The most considerable use of the downstream area of Cisokan River at the downstream dam is as a source of irrigation water for the Cihea irrigation area. The water flow of the Cisokan river will be in the Cisokan weir which flows into the Cihea irrigation channel. The Cisokan Dam (Cisokan Weir) is approximately 3 km downstream from the UCPS lower dam. The irrigated area of Cihea is 5,484 ha.

Dam filling activities can affect the availability of water downstream. Potential impacts on river use downstream of the Cisokan River include:

- Limited water availability due to reduced river discharge.
- Reduced risk of flooding over river banks.
- Riverbed users and adjacent landowners can no longer predict river discharge or flooding based on rainfall, as they could before. High rainfall does not always coincide with rising river levels.
- Reduced water quality and dilution effect

The availability of water for the Cihea Irrigation System should not be affected during the inundation process. The river discharge will be reduced by up to 6.21m^3/s. Section 6.7.3 demonstrates the monthly average water flow during the wet season and it is anticipated that during average conditions there will be enough discharge downstream to provide for the

Cihea Irrigation Scheme. Section 6.8 explains the low flow conditions and impacts on the Cihea Irrigation Scheme.

There are many river users who depend on the Cisokan River for irrigation supplies from the Cihea Irrigation System, but only a few use the river for fishing. Fishing will not be disrupted during the inundation phase as the flow will remain within the existing flow expected during the wet season and will not affect fish abundance. Fishing is not usually done during high flow and this further reduces the potential for impact. All warning signs/sirens for floods or emergencies will operate prior to inundation and will be used during inundation if necessary.

Prior to inundation, PLN will communicate and inform all river water users in the downstream area, including farmers and the Cihea Irrigation System, about changes in river flow due to inundation. Reservoir filling occurs during the wet season (December to May). Using the monthly mean river flow during the wet season (21.9m^3/s), reservoir filling will be carried out over a period of approximately 122 days, or three months (Table 14). The actual schedule for filling will depend on river flow conditions during the rainy season and residual flow from the lower reservoir (which will fluctuate during the filling period). Consultation will provide an opportunity for the community to raise problems and to give PLN and the community the opportunity to work together to find suitable solutions before the filling process begins. This process will be documented in the Social and Community Sub-Plan in the Operational Environmental Management Plan.

The impact assessment of downstream users at the inundation stage is shown in Table 97 .

Table 97. Downstream User Impact Assessment during the Inundation Stage

Impact	The potential for hampering the quality of life and activities of downstream communities that use river resources.				
Impact Nature	Negative	Positive	Neutral		
	Reservoir filling requires taking up to 6.21m^3/s of water from the Cisokan River during the wet season during which time the average monthly mean flow is 21.9m^3/s.				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	Weir operation requires stable Cisokan discharge, in the dry season the Cisokan discharge will decrease and that will affect the flow rate downstream of the weir.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	The actual schedule for filling/inundation will depend on river flow conditions during the wet season (possibly higher than the annual mean river flow most of the time) and residual flow from the lower reservoir (likely to fluctuate during the filling period). Approximately 122 days or four months will be needed.				
Impact Extent	Local	Regional	Global		
	The flow rate may be reduced and affect the downstream community. The downstream areas that could potentially be affected by the project area are Salamnunggal Village, Cikondang Village and Panyusuhan Village and the Cihea Irrigation Scheme, 3km downstream.				
Impact Magnitude	No change	Slight	Low	Medium	High
	The magnitude of the impact on reducing the discharge flowing to this part of the region is the Cihea irrigation area with an area of 5,484 ha. The filling process carried out in the wet season will have a low effect on the water demand in the irrigation area, because the UPCS is only taking up to 6.21m^3/s compared to an average monthly mean flow of 21.9m^3/s. At low flow periods during the wet season, filling the UCPS will reduce the water take and will discharge at least 1.7m^3/s downstream at all times. Low flow periods during the wet season are unlikely. Furthermore, UCPS and Cihea Irrigation Scheme can negotiate for more water to be discharged downstream if necessary during the inundation period.				

Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
	The irrigation scheme users are sensitive to water availability because of the reliance on water for livelihoods.				
Impact Severity	Slight	Low	Medium	High	Very High
	Low impact magnitude and medium-high receptor sensitivity show high impact severity.				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood / Inevitable
	The impact of inundation on river users in the downstream part of Cisokan has the potential to occur, especially when viewed from the reduced discharge that will flow. However, this impact has a low likelihood because the inundation process is carried out during the wet season and UCPS lower dam discharge should be higher than the irrigation needs during average conditions.				
Significance	Negligible	Minor	Moderate	Major	Critical
	The high impact severity with low likelihood leads to Moderate Significance.				

Based on the impact assessment, it is known that the effect of the inundation process on downstream river users leads to a minor significance impact. Therefore, the impacts that are observed remain insignificant.

Mitigation: The inundation process is carried out in accordance with the established SOP which includes the e-flow regime detailed above.

11.3.2 Community Connectivity (Bridge Access)

Community connectivity will affect families who will not be resettled, there may be periods of unrest and disturbance during resettlement where service facilities and religious buildings are lost or moved, and employment and business opportunities change. Furthermore, during land clearing and reservoir preparation, the productive environment of the forest or river, or access to a walking or motorbike path, including river crossing, may change or be permanently displaced. The new bridge will connect parts of the village and will be constructed and operational prior to inundation, to prevent the isolation of communities from markets, schools and communities in the West.

The project locations include KBB and Cianjur; the two districts are separated by the Cisokan river. Currently, people's access to move from KBB to Cianjur, or vice versa, is possible due to the low volume of water. At the location of Margaluyu village in Cianjur Regency there is a bamboo bridge as a connection with the Jolok Block in West Bandung Regency, which is also a resettlement area for the UCPS project.

The connectivity bridge from Blok Jolok to Margaluyu Village is made of bamboo and can only be accessed by foot and motorbike. The trip to the bridge location is also through a path and is quite steep. Even so, the bridge is very useful for community connectivity, which mainly uses the bridge to carry crops / livestock, and access land and fishing grounds.

The impoundment phase of the Cisokan dam can cause the bridge to be submerged so that people wishing to cross need to access farther roads. The loss of the bridge can affect the connectivity of the community, especially the people of Margaluyu and Blok Jolok villages.

The village government has tried its best to propose the construction of a bridge in Margaluyu village, but until now only a small part has been realized, despite donations and community self-help.

Table 98. Community Connectivity Impact Assessment (Bridge Access)

Impact	Community connectivity is obstructed due to the submerged bridge				
Impact Nature	Negative	Positive	Neutral		
	By submerging the bridge that connects the villages, it will have a negative impact on daily activities, especially in carrying out economic activities				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	The impact of impoundment will cause the bridge to be submerged, limiting community access.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	The duration of the impact will occur during the inundation time but impacts will remain permanent.				
Impact Extent	Local	Regional	Global		
	The impact is local in nature because it only covers the community area in Blok Jolok and Margaluyu				
Impact Magnitude	No change	Slight	Low	Medium	High
	The impact on community connectivity is considered Medium. This is due to limited access if there is no connecting bridge between locations.				
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
	There is still road access to cross the river by taking the longer distance through district roads, however the existence of the bridge is really useful to the community. The village government tried to propose the construction of a bridge through donations from the community.				
Impact Severity	Slight	Low	Medium	High	Very High
	The combination of medium impact magnitude and medium Receptor Sensitivity categorizes the impact severity as High.				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood / Inevitable
	The likelihood of the resulting impact is at a low level. The community still has access or connectivity but detours are required.				
Significance	Negligible	Minor	Moderate	Major	Critical
	The impact severity of high, with low likelihood, leads to a Major Significance				

Mitigation

Bridge replacement constructions will be suggested to PLN as a part of Infrastructure assistance, with the realization before impoundment.

CHAPTER 12. ENVIRONMENTAL AND SOCIAL IMPACT – OPERATIONAL STAGE

12.1 Introduction

The operational stage involves the generation process at UCPS and the distribution of electricity to the transmission network. The following list is an outline of the environmental and social impacts that are expected to arise during the operational phase at the UCPS site and transmission line:

- Impacts on river habitats and biodiversity
- Impact on erosion and sedimentation
- Impact on river and reservoir water quality
- Impact due to the construction of transmission lines
- Impact on land cover in the area around the reservoir / reservoir
- Impacts along the access road
- Potential impacts on public health around transmission lines
- Potential increase of water borne diseases

Each impact is described further in each section in this chapter.

12.2 Environmental Impact Operational Stage

12.2.1 Erosion and Sedimentation

The process of pumping and releasing water in the pumped storage hydropower work system causes a rapid change in the water level in the reservoir. During the generation activity, the change in water level in the lower reservoir is 4.5 m in 6.5 hours (0.7 m/hour) and a change of 19.0 m in 6.5 hours (3 m/hour) in the upper reservoir. The process of rising and falling water levels has the potential to erode the soil layer in the reservoir area, and contribute to the sediment that enters the reservoir.

The two dams will form a barrier to natural sediment movement. Some of the suspended sediment will be released through the bottom outlet and passed to the downstream flow, but the majority of the river load will not be carried. The main impact is to increase river energy to transport riverbed sediment to the lower dam on the Cisokan River. This allows for changes in river morphology, particularly the erosion of cliffs and riverbeds, and the novel occurrence of riverbed and riverbank erosion. However, sedimentation originating from erosion of the upstream part of the Cisokan River will be contained by the lower dam, thereby reducing the sedimentation rate in the downstream area of the lower dam. The reduction in the rate of erosion and sedimentation will have a positive impact, especially for the Cihea irrigation channel. This will reduce the amount of sediment deposition in the Cihea irrigation channel which can lead to silting of the channel.

The contribution of sediment into the reservoir environment comes from the area of the potential landslide zone (unstable slope) in the reservoir and erosion that occurs in the Cisokan watershed due to changes in land use. Zones of potential landslides and unstable slopes were identified in the upper and lower reservoirs of the UCPS. Based on the identification results, there are 7 unstable slope zones in the upper reservoir (Zone A-G) and

10 landslide potential zones in the lower reservoir (Zone 1-10). The potential landslide zones and unstable soil in the upper and lower reservoirs of UCPS are shown in Figure 111.

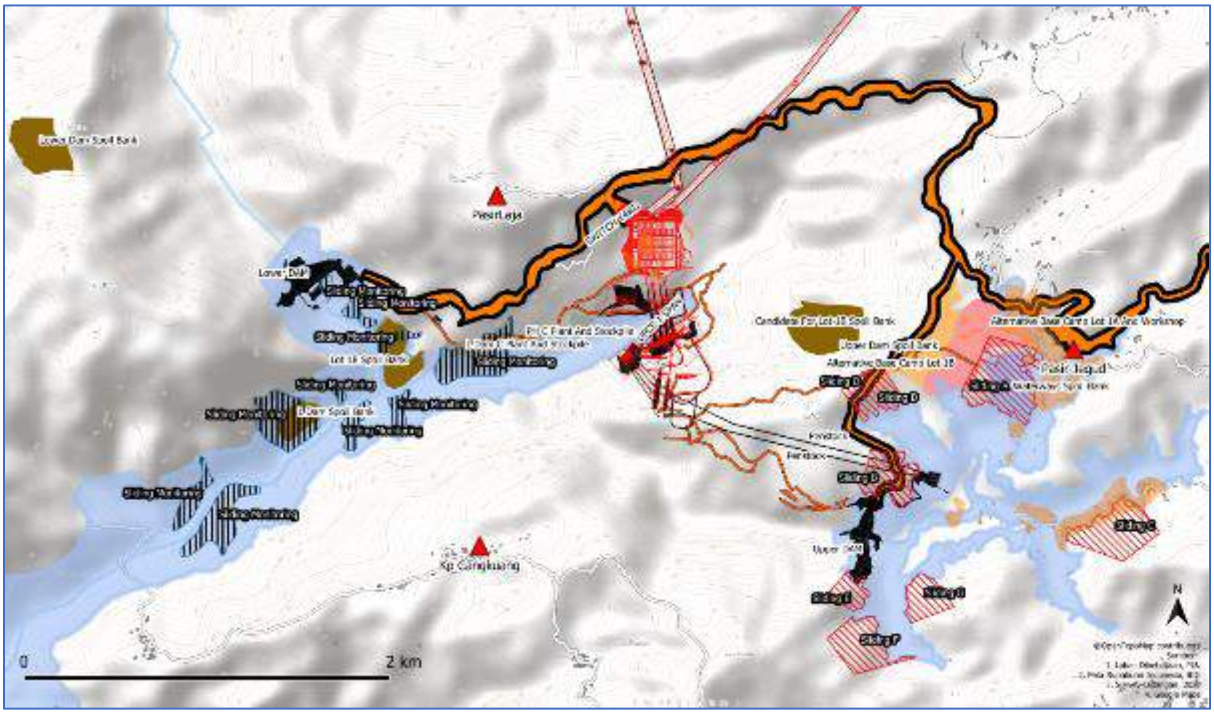

Figure 111. Potential Landslide Zone and Unstable Soil in the UCPS Reservoir

The main weir building and other supporting facilities at the UCPS operational site provide changes in land use that contribute to changes in the amount and rate of erosion in the Cisokan watershed.

Analysis of the potential impacts of erosion and sedimentation during construction uses the USLE (Universal Soil Loss Equation) method approach. The calculation is based on the pattern of land changes that occur under pre-construction conditions at the UCPS site. Based on the results of the analysis, it is known that the existence of facilities at the UCPS location has an impact on the potential for erosion changes in eight villages in the Cisokan watershed, namely Bojong Village, Cinengah Village, Girimulya Village, Karangnunggal Village, Margaluyu Village, Sukajadi Village, Sukamanah Village, and Sukaresmi Village. The potential for erosion that occurs in existing and operational conditions is shown in Table 99.

Table 99. Potential Erosion at UCPS Sites

No.	Villages	District	Existing Potential Erosion (ton/year)	Operation Potential Erosion (ton/year)
1.	Bojong	Rongga	26,206.26	34,271.46
2.	Cinengah	Rongga	20,939.98	21,399.21
3.	Sukaresmi	Rongga	53,409.49	103,427.62
4.	Girimulya	Cibebe	7,916.92	4,131.42
5.	Karangnunggal	Cibeber	4,984.19	2,769.15
6.	Margaluyu	Campaka	9,543.03	7,070.85
7.	Sukajadi	Campaka	6,024.88	5,695.76
8.	Sukamanah	Rongga	24,538.88	21,349.11

The potential erosion rate at each location is then classified according to the erosion rate class according to Suripin (2001) (Table 100).

Table 100. Potential Erosion Rate in UCPS Sites

No.	Villages	District	Potential Existing Erosion Rate (ton/ha/year)	Operation Potential Erosion Rate (ton/ha/year)	Classification	
					Existing	**Operational**
1.	Bojong	Rongga	13.71	17.93	Very Mild	Mild
2.	Cinengah	Rongga	26.93	27.52	Mild	Mild
3.	Sukaresmi	Rongga	41.27	79.92	Mild	Moderate
4.	Girimulya	Cibeber	32.49	16.96	Mild	Mild
5.	Karangnunggal	Cibeber	15.92	8.84	Mild	Very Mild
6.	Margaluyu	Campaka	10.47	7.76	Very Mild	Very Mild
7.	Sukajadi	Campaka	8.61	8.14	Very Mild	Very Mild
8.	Sukamanah	Rongga	10.80	9.40	Very Mild	Very Mild

Based on Table 99 and Table 100, it can be seen that, during the operational conditions of UCPS, an increase in the rate of erosion is likely to occur in three villages, namely Bojong Village, Cinengah Village, and Sukaresmi Village. The reduction in the rate of erosion will occur in 5 villages, namely Girimulya Village, Karangnunggal Village, Margaluyu Village, Sukajadi Village, and Sukamanah Village.

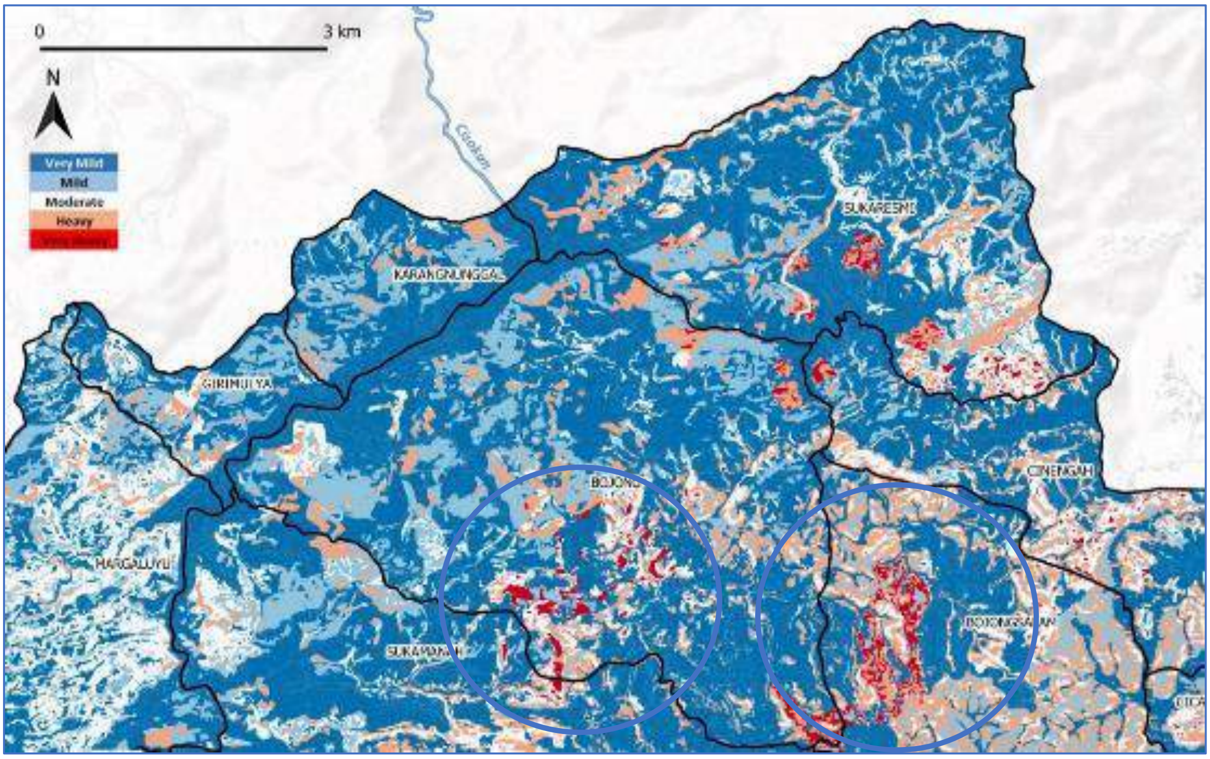

Figure 112. The distribution of the erosion strip based on the classification of the UCPS Operational Stage in the Cisokan watershed

Based on the classification, at the time of operation 4 villages were in category I (Very Mild), 3 villages were in category II (Mild), and 1 village was in category III (Moderate). The erosion model result ranges according to the original erosion rate in the previous study and can be considered as an upper and lower bound in erosion sedimentation management. Any erosion rate, based on classification in the Cisokan watershed area, is shown in Figure 112.

The products of erosion and sedimentation will not directly flow into the river body. It will fill the basin and cavity on the watershed first before flowing into the river body. This process may, however, be affected if there is no treatment during the construction activities phase and future land use regulations in the upper Cisokan watershed.

The prediction of operational activity of UCPS kept the value of erosion rate at 1.86 mm/year/km^2, corresponding to 309 years of upper dam and 88 years of lower dam use (PLN Enjiniring/Nippon Koei/Newjec Inc./Indokoei International/Wiratman, 2019a). However, the HV curve predicted to meet the dead storage for 50 years in both reservoirs. Sedimentation will occur in each of reservoir and there are still no plans to dredge the reservoir. Reduced sediment deposition will make the discharge have more 'energy' that will potentially erode the riverbed.

The erosion and sedimentation impact assessment of the Cisokan river at the operational stage of the UCPS dam is shown in Table 101.

Table 101. Impact Assessment of Erosion and Sedimentation Changes in the Cisokan River during the Operational Stage

Impact	The increase in the amount of sedimentation in the UCPS reservoir is due to erosion in the reservoir area and erosion that comes from changes in land use in the Cisokan watershed.				
Impact Nature	Negative	Positive	Neutral		
	Erosion that occurs in the operational stage is a negative impact that can increase the amount of sediment in the UCPS reservoir which will affect the silting of the weir.				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	Erosion that occurs both in the reservoir area due to rapid water level changes and changes in land use will be a source of sediment that enters the river and is partially retained in the UCPS reservoir.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	Erosion-sedimentation occurs because surface runoff carries eroded material to water bodies, which then settles. These impacts can occur throughout UCPS operations.				
Impact Extent	Local	Regional	Global		
	The impact of erosion-sedimentation is a decrease in the quality of the land in the catchment area due to decreased vegetation or silting of the lower reservoir.				
Impact Magnitude	No change	Slight	Low	Medium	High
	7 zones of unstable slope in the upper reservoir (Zone AG) and 10 zones of potential landslides in the lower reservoir (Zones 1-10) with a large total area. The increased rate of erosion in the Cisokan watershed, due to changes in land use during operations, will impact 4 villages in category I (Very Mild), 3 villages in category II (Mild), and 1 village in category III (Moderate).				
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
	The sensitivity to live receptors is not that great but the impact of erosion and sedimentation is sensitive to the UCPS reservoir, in relation to the operational life.				
Impact Severity	Slight	Low	Medium	High	Very High
	Medium impact magnitude, and low-medium receptor sensitivity, indicates medium impact severity.				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood / Inevitable

Significance	Erosion contributes to the introduction of sediment into water bodies and is held in reservoirs. This is deemed a definite impact.				
	Negligible	Minor	Moderate	Major	Critical
	The impact severity of medium, with medium likelihood, leads to Minor-Moderate Significance				

The results of the impact assessment of erosion and sedimentation at the UCPS operational stage showed a minor-moderate significance level.

12.2.2 Changes in River Flow, and Water Availability for UCPS Downstream Users

Unlike conventional hydro schemes, a pumped storage scheme only cycles water between reservoirs; there is no capture and storage of water for future use and no net downstream discharge when generating electricity. To maintain the active storage capacity within the pumped storage system, the scheme is designed to pass excess water downstream rather than store it within the reservoirs. So, as discussed in Section 4, most of the water that flows into the two reservoirs will either be passed through the bottom outlet or over the spillway so that the downstream hydrology will be very similar to the existing situation.

Cirumamis River:

The downstream flow in the Cirumamis River will be the same as the inflow for all flows. The exception being during low flow periods (less than 0.01 m^3/s), the downstream flow releases may exceed inflow. Any top up water to make up for evaporation will come from the Cisokan River. The bottom outlet of the upper dam allows a minimum discharge of 0.01 m^3/s and a maximum of 0.96 m^3/s. The discharge will flow directly into the Cirumamis River. The residual flow will decrease during periods of low discharge (dry season and dry period in the rainy season) in accordance with the reduced inflow into the reservoir. The maximum discharge of 0.96 m^3/s will be observed during the rainy season or during high rainfall. Any discharge greater than 0.96 m^3/s will be discharged via the spillway when the reservoir is at full capacity.

Because the downstream flow will be maintained, there are no anticipated impacts on the flow, or habitat of the Cirumamis River, including the waterfalls.

Cisokan River:

The downstream flow in the Cisokan River will be the same as the inflow for all flows except for a small amount of water take, anticipated to be 0.2 m^3/s, to replenish evaporation from the two reservoirs. The required 'top up' water will have no noticeable effect on the downstream Cisokan River during most flows, with the exception of extreme low flow periods (less than Q97). For example, at Q97 inflow of 1.7 m^3/s, the downstream flow will be 1.5 m^3/s.

In 2014, the Ministry of PUPR issued Ministerial Decree No. 619 / KPTS / M / 2014 concerning the granting of water resources utilization permits (SIPA) from the Cisokan River to PT. PLN (Persero). To maintain water availability for the purpose of river maintenance, a minimum e-flow of 0.55 m^3/s is permitted by the SIPA water resources utilization permits (Section 11.2.1, Table 102. During the dry season, where the Cisokan River discharge is below 0.55 m^3/s, UCPS must discharge at least 0.55 m^3/s. Using the rationale that the scheme only takes 0.2m^3/s, this minimum e-flow would be reached when the inflow is at, or below, 0.75m^3/s. At flow between 0.75m^3/s and 0.55m^3/s, the 'top up' water of 0.2 m^3/s would be reduced until it reached 0 m^3/s, in order to meet this minimum e-flow. This means that the active storage would be slightly reduced during this period. At flow below $0.55m^3/s$, the e-flow will be maintained at $0.55m^3/s$ and water will be taken from the active storage. This situation will likely only occur for up to a few days in any one year.

In extreme drought conditions, the SIPA states that the UCPS must discharge a minimum e-flow of 0.01 m^3/s to meet the permit requirements and maintain water flow for the Cihea Irrigation Scheme. This means, if the natural inflow reduces to, or below, 0.01 m^3/s, the UCPS scheme can reduce the e-flow to no less than $0.01m^3/s$.

Table 102. Proposed operational regime for inflow and outflow during operation

Scenario	All flows = >0.75	Very low flow	Q97 – Q 100	Extreme low flow
Natural inflow m^3/s	>= 0.75	0.75 - 0.55	0.55 - 0.01	<0.01
Intake for UCPS Scheme m^3/s	0.20	0.20 - 0 (Inflow – 0.55)	0 (water released from active storage)	0 (water released from active storage)
Residual flow discharge downstream lower dam m^3/s	>= 0.55 (Inflow – intake)	0.55	0.55	0.01

Utilization that does not neglect ecosystem protection refers to Government Regulation no. 38 of 2011 concerning rivers; the UCPS is required to maintain a reliable Q95 discharge of 1.59 m^3/s (PJT II, 2019). According to the analysis above, the UCPS will achieve this flow at approximately Q97, meaning it will maintain a higher Q95 flow than that required by the regulation.

The operational flow regime will not affect the ecological and biodiversity values in the river. The minor changes in flow will not affect the water depth, velocity, wetted area, depth and other significant ecosystem features, compared to the baseline. Fish and macroinvertebrate species are adapted to diurnal and seasonal flow changes and are not expected to be adversely affected. Habitat impacts are discussed in Section 10.2.2.

Water requirements during the operational process also consider water needs for irrigation in Cihea. The small water requirements of $0.2m^3/s$ will have little to no impact on the irrigation scheme compared to the existing river flow, except at very low flow periods. The Cihea scheme already adapts to the flow variation in the Cisokan River and adjusts the intake from a minimum of $0.22m^3/s$ to $7m^3/s$, depending on flow availability and the irrigation needs. During low flow periods in the dry season months of August and September, the Cihea Irrigation Scheme often takes little or no flow from the river, which limits the risk of the UCPS water needs affecting the scheme at this time. There will be a perception that the UCPS will be responsible for any droughts / lack of water availability and conversely, for floods. To manage water flow expectations and to prevent conflicts it is prudent that the UCPS and Cihea Irrigation Scheme work together to share real time flow information and early warning systems.

There is very little opportunity for flood attenuation by the scheme. The available live storage capacity is small and designed for daily peaking generation. At any one time there will only be approximately 10,000,000 m^3 of active storage available, which, for example, could attenuate 3 hours of peak flow for a 100y return flood (891m^3/s) or 6 hours if half the flow is attenuated. Using the active storage for flood attenuation would result in the generation capacity not being available during the flood event.

The flow regime, including maintaining a minimum e-flow above the rate of inflow flood attenuation, and early warning systems, as well as any cooperation between UCPS and Cihea Irrigation Scheme must be developed as operational procedures in the Operational Environmental Management Plan.

The impact assessment of the flood discharge and low flow of the Cisokan River at the operational stage of the UCPS scheme is shown in Table 103.

Table 103. Impact Assessment of Cisokan River Flow During the Operational Stage

Impact	Changes to the natural flow regime in the river				
Impact Nature	Negative	Positive	Neutral		
	There will be a very small impact of the UCPS operation by reducing the flow in the Cisokan River by 0.20 m^3/s to make up for evaporative losses in the two reservoirs. The flow downstream in the Cirumamis River will be maintained at the rate of inflow, except during periods at or below 0.01m^3/s where it will be maintained at 0.01 m^3/s.				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	Minor changes in flow patterns in the downstream of Cisokan River and Cirumamis Rivers are a direct impact of the UCPS				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	Changes in the flow regime in the Cisokan and Cirumamis Rivers will take place during the operational life of UCPS.				
Impact Extent	Local	Regional	Global		
	Changes in the flow regime in the Cisokan Rivers will have minor impacts to the Cihea Irrigation Scheme, which is about 3 km below the lower dam.				
Impact Magnitude	No change	Slight	Low	Medium	High
	The main component of the impact is how the discharge in the Cisokan and Cirumamis rivers should be maintained for UCPS operations and use for the community downstream of the river, especially in Cihea scheme, so that during the dry season / low flow periods needs can be met. However, based on the water balance graph, during the minimum conditions in August and September, the flow conditions still show a surplus after deducting for evaporation and withdrawal by UCPS. The water take requirements for the scheme is a very small percentage of the flow for most of the time, to at least the Q97 flow. Beyond Q97 flow the modifications will be slight. The UCPS scheme will increase the flow in the river during very low flow periods.				
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
	The Cihea Irrigation Scheme users are sensitive since there are a large number of households who rely on the water for income and livelihoods who would be anxious about any reduction in water availability. Rice growing is a significant contribution to the local economy.				
Impact Severity	Slight	Low	Medium	High	Very High
	Impact magnitude slight, and receptor sensitivity medium, shows the impact severity as a low.				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood/Inevitable
	Change of flow will occur due to the need to top up evaporative losses.				

Significance	Negligible	Minor	Moderate	Major	Critical
	Impact severity low, with likelihood high / inevitable, result in Minor Significance.				

12.2.3 River Habitat

The inundation will affect changes in river habitat in the Cirumamis and Cisokan Rivers. Habitat changes will occur in inundated areas. Fish species that depend on clear, fast flowing water conditions, for living and spawning, will reduce home ranges when inundation occurs. Direct habitat loss includes several kilometers of upland 'riffle, run, pool' habitat. The upstream and side watersheds are available as alternative living areas. The reservoir will be a habitat for goldfish, tilapia and snakehead, which can adapt to the lake environment.

Heavy flow at the beginning of the rainy season is a sign for aquatic biota, especially fish, to lay eggs, meaning efforts must be made to maintain natural water flow. The natural flow of the river during operation will approach the natural flow conditions prior to the construction of the weir, especially at average flow and high flow. This environment should not be damaged by the Upper Cisokan hydropower activities. The low flow will be maintained according to the downstream river ecosystem to prevent drought throughout the year.

The reservoir environment is a water body that is not suitable for aquaculture activities, but the surrounding community does not have an alternative for wild fish. Decrease in food sources for aquatic biota and substantial changes in fish communities have been identified, so mitigation efforts need to be undertaken, including introducing feed source species or capturing and releasing species in the upstream and downstream of the dam. As part of the aquatic system consists of Natural Habitat, a no net loss objective is required. The ecological restoration of riparian areas through reforestation, as detailed in the BMP, aims to improve the health of aquatic areas by offsetting losses occurring during the operational stage.

Riparian habitats along rivers will also disappear when inundated. These habitats are important for amphibians, reptiles and some birds. This cannot be replaced by a reservoir, because the water level will fluctuate sharply in a short period of time, due to the operational nature of pumped storage, making the riparian area uninhabitable. These species must seek alternative habitats in the upstream side streams and tributaries. The impact assessment on river habitats at the operational stage of the UCPS dam is shown in Table 104.

Table 104. River Habitat Quality Impact Assessment during the Operational Stage

Impact	Changes in river habitats in the upper dam inundation areas increase the quality of water bodies due to the self-purification process, thereby increasing the quality of the habitat for aquatic biota.				
Impact Nature	Negative	Positive	Neutral		
	Changing flowing water bodies into more or less stagnant lakes can also reduce the quality of river habitats if the filtering capacity of water bodies is not able to compensate for the amount of incoming contamination.				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	The impact of increased pollution is the emergence of weeds and a decrease in water quality, which can interfere with the performance of the weir.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	The upper weir and the lower weir are water bodies that can naturally self-purify, so that the water quality can be improved as long as the amount of contamination entering is still within the				

	tolerance stage. The weir's water body is not used as a place for fish farming during operations, so it will greatly assist in the process of improving water quality				
Impact Extent	Local	Regional	Global		
	The quality of water stored in the weir body will experience improvement so that the water in the weir body will be better than the quality of incoming water. The downstream area will also experience improvement as a result.				
Impact Magnitude	No change	Slight	Low	Medium	High
	The decrease or increase in water quality will have an effect on the habitat of water bodies, this will affect the characteristics of aquatic biota				
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
	Water body characteristics are indices that can be observed and measured as water quality information				
Impact Severity	Slight	Low	Medium	High	Very High
	Medium impact magnitude and low-medium receptor sensitivity show medium impact severity.				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood / Inevitable
	Changing conditions in river habitat due to a dam is a definite impact				
Significance	Negligible	Minor	Moderate	Major	Critical
	The impact severity of medium, with medium likelihood, leads to a minor-moderate significance				

Mitigation measures may include development of riparian habitats in buffer zones. Further efforts will be carried out with an adaptive management program from the Biodiversity Management Plan. Biodiversity monitoring before and after the Upper Cisokan hydropower plant operates, along sections of the Cisokan river and tributary, will provide evidence of changes in riparian biodiversity, and potential signs of mitigation efforts to prevent significant loss / change.

12.2.4 River Water Quality

Water quality is influenced by both land use, and use and discharge of water in the catchment area. Deteriorating water quality can have an impact on the ecology of waters and downstream water users.

Changes in water quality are most likely due to inundation and operations. Initially BOD5, COD and nutrient concentrations may increase, and dissolved oxygen concentrations will decrease, due to decomposition of the remaining vegetation after reservoir preparation and from inundated soils. There is also the possibility of sediment from the ground surface of the reservoir body entering the reservoir after inundation, increasing sediment load at the edge of the inundated area.

The increase in population also has an impact on the increased waste generated. Household waste has a significant impact on water bodies. The results of water quality monitoring in the Cisokan River show that domestic waste, especially organic waste contamination, and land management are the main causes of water quality decline.

Domestic waste which has a high organic matter content will increase environmental parameters with respect to the decomposition process of organic matter, namely Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD). The results of the calculation of the pollution load projection for BOD and COD parameters show that there is an increase in BOD and COD in the Cisokan catchment, which will be discharged into water bodies. Pollutant loads for each village in the Cisokan catchment area, with respect to BOD parameters, are presented in Figure 113.

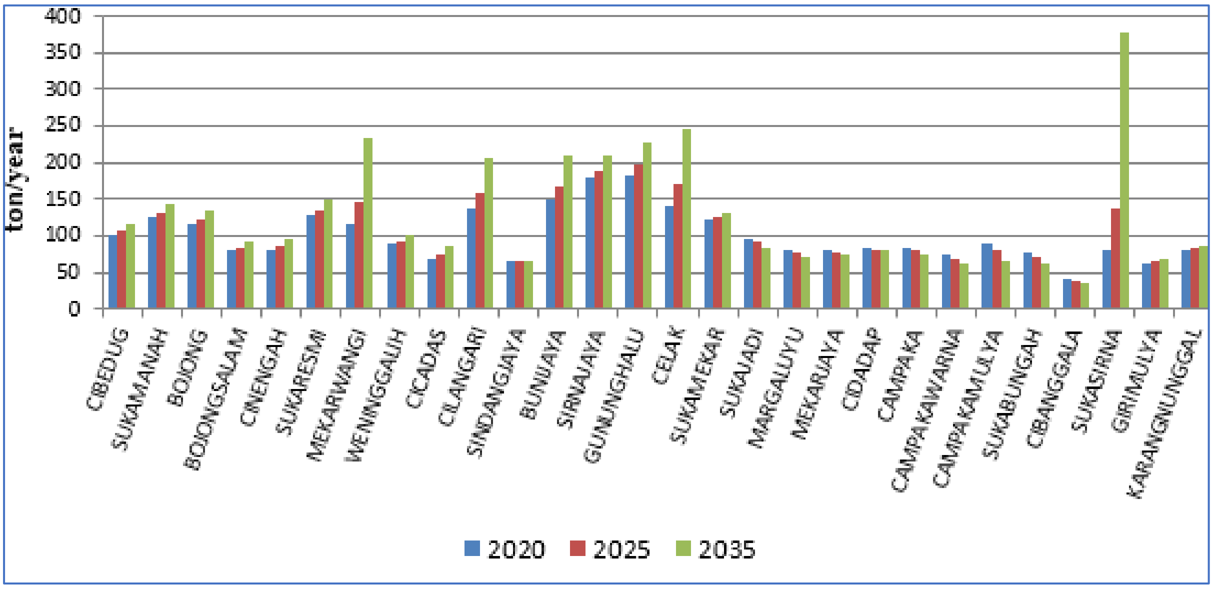

Figure 113 Projected village pollutant load in the Cisokan catchment area for BOD parameters for 2020-2025-2035

The results of the pollutant load analysis show that an increase in the population of the area, particularly due to the need for migrant workers during the construction phase, will increase the amount of organic contaminants in water bodies.

An increase in population will increase the amount of contaminants discharged into water bodies. Increasing BOD and COD concentrations will affect the water quality, especially as habitats for aquatic organisms. The impact that occurs from the increase in contamination is a decrease in the diversity of biota, especially biota sensitive to pollution. The distribution of the load for COD parameters is presented in Figure 114.

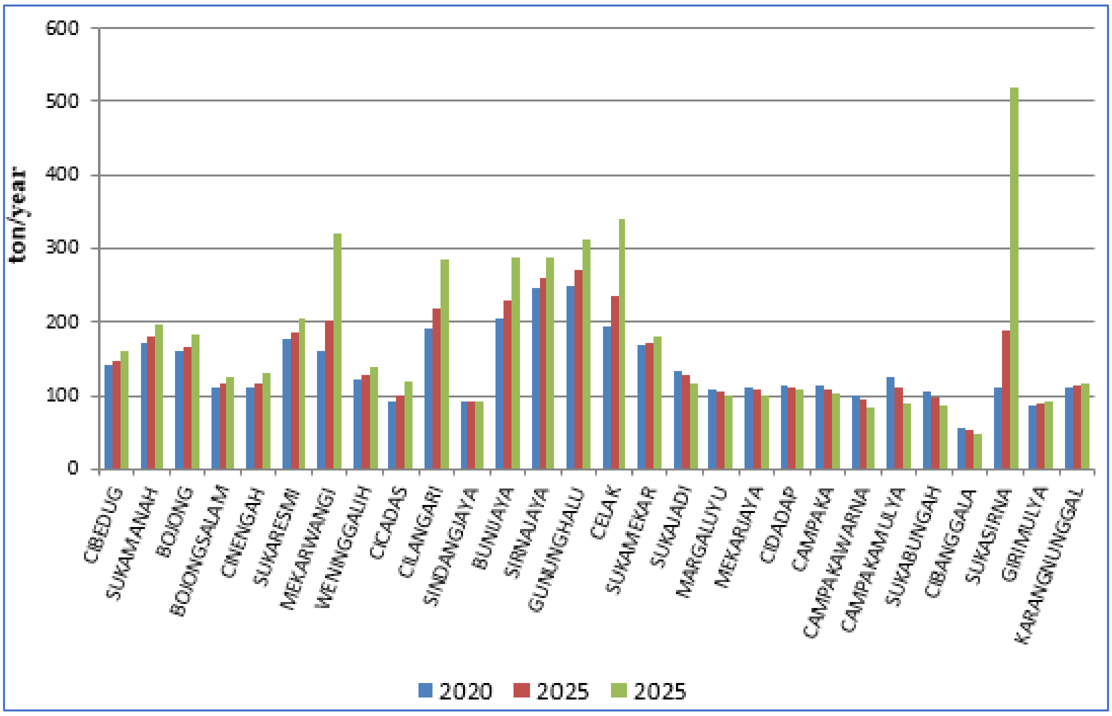

Figure 114. Pollution Load per Village for COD Parameters in 2020 - 2025 – 2035

Other parameters related to human activity, besides organic parameters, are the parameters of suspended sediment or Total Suspended Solids (TSS). TSS is a form of contamination from human activities that causes soil and other materials to flow into water bodies. An increase in suspended solids increases turbidity and sedimentation, and can therefore be used as an indicator of erosion in catchment areas. The total amount of village dissolved solids in the Cisokan catchment area is presented in Figure 115.

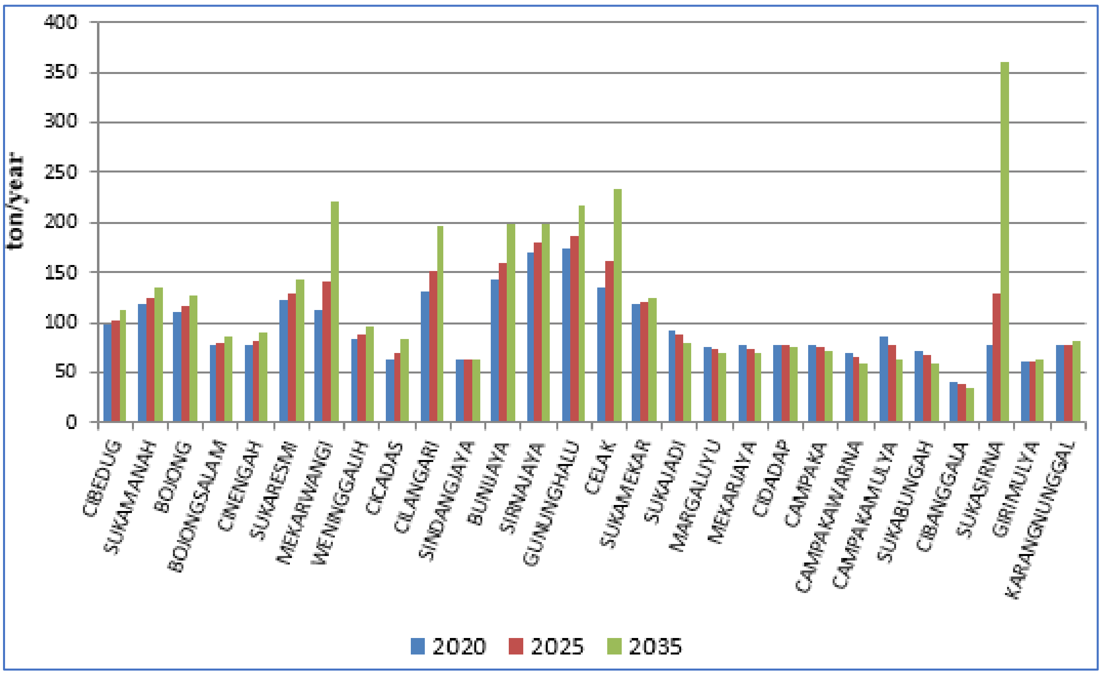

Figure 115. Pollution Load per Village for TSS Parameters for 2020 - 2025 – 2035

The impact assessment on the reduction of water quality of the Cisokan River during the operational stage is shown in Table 105.

Table 105. Cisokan River Water Quality Impact Assessment Operational Stage

Impact	Decreasing water quality and changing river habitat in the Cisokan river; especially with regard to increased levels of pollutants from domestic waste and suspended solids.				
Impact Nature	Negative	Positive	Neutral		
	The increase in the population of the catchment area (residents and workers) increases domestic waste, which causes an increase in the pollution load to water bodies.				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	The increase in the number of non-point source pollutants, in the form of domestic waste, increases the pollution load directly, especially for the parameters of BOD, COD and TSS. These impacts are cumulative, as pollution is already existent but will increase due to the increase of population in the area.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	The increase in environmental pollution load from domestic waste can be temporary or long term depending on the efforts made, because the pollutant load can be reduced through controlling the amount of pollution that is channelled into the river.				
Impact Extent	Local	Regional	Global		
	The increase in the pollution load to the Cisokan water body will have an impact on decreasing the quality of the river habitat for aquatic organisms, resulting in a decrease in the diversity and abundance of aquatic biota.				
Impact Magnitude	No change	Slight	Low	Medium	High
	The projected amount of BOD entering the Cisokan water body in 2020 = 2,825.46 tons/year, 2025 = 3,010.67 tons/year, and 2035 = 3,590.77 tons/year. Projected amount of COD in 2020 = 3,885.01 tons/year, 2025 = 4,139.68 tons/year, 2035 = 4937.31 tons/year. Projected total TSS in 2020 = 2,684.19 tons/ year, in 2025 = 2,860.14 tons/ year, in 2035 = 3,411.23 tons/year.				
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
	Changes in water quality will affect the overall aquatic biota and communities dependent on the river.				
Impact Severity	Slight	Low	Medium	High	Very High
	Medium impact magnitude and low-medium receptor sensitivity show medium impact severity.				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood / Inevitable
	The decline in water quality will generally occur as a result of increasing domestic pollution.				
Significance	Negligible	Minor	Moderate	Major	Critical
	The impact severity of medium, with medium likelihood, indicates Minor-Moderate Significance				

12.2.5 Land Use Changes, specifically around the transmission lines

UCPS activities include the construction of Upper Dam, Lower Dam, Power Plant Facilities and transmission lines requiring land. These activities will change the land from vegetated to developed land. Land use change analysis is carried out by analyzing the identification of actual use through the use of high-resolution satellite imagery data coupled with field surveys. The basic data is presented as a reference map of topography from the Geospatial Information Agency. The plan map is generated from the actual map, coupled with the UCPS activity site planning, so that land use changes that will occur can be identified. The land use change analysis is carried out by comparing the actual conditions and the site plan as well as the regulations regarding the conditions accompanying the site plan.

Changes in land use that are due to occur in UCPS project activities are:

- Changes in land use in the Gunung Karang area due to the process of taking rock material
- Changes in land use in the access road area and its corridors which are used as a conduit to the weir location and generating facilities
- Changes in the use of the weir, both the weir body and the weir's water body as a source of water for power generation
- Change in land use of power generation facilities and supporting facilities
- Changes in land use in the transmission line area are related to transmission line safety requirements

Changes in land use will have an impact on many aspects including hydrological, landscape, sediment erosion, environmental health, food security and wood supply.

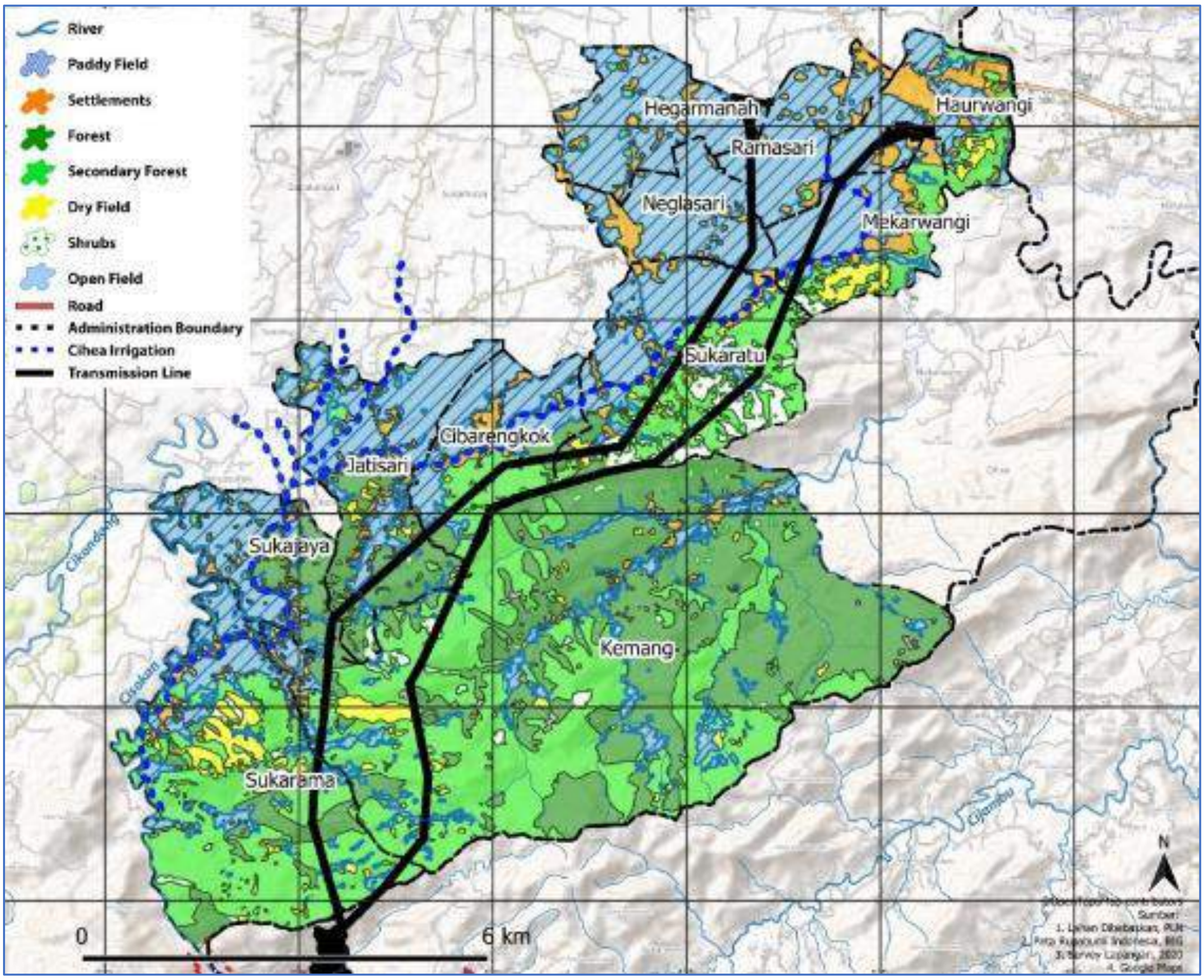

Figure 116. Land Use on the UCPS Transmission Line

The UCPS transmission line, that stretches from the location of the generating facility to the intersection of the 15 km Saguling hydropower plant, has an impact on land use (Figure 116). Changes in land use occur with respect to regulations regarding free space and minimum clearances on high-voltage overhead lines, in accordance with the Regulation of the Minister of Energy and Mineral Resources (PERMEN ESDM) No.2 of 2019.

PERMEN ESDM No. 2019 states that the minimum vertical distance from the conductor and the minimum horizontal clearance from the vertical axis of the tower/pole are adjusted to the type of overhead line and the voltage capacity supplied. The area of minimum vertical and horizontal distance of airways is presented in Table 106.

Table 106. Minimum Vertical and Horizontal Clearance Distance for Types of Transmission Lines and Voltage

No.	Location	SUTT (High Voltage Line)		SUTET (Extra High Voltage Air Line)		SUTTAS (Direct Current High Voltage Air Duct)	
		66 kV (m)	**150 kV (m)**	**275 kV (m)**	**500 kV (m)**	**250 kV (m)**	**500 kV (m)**
1	Open field or open area	7.3	8.5	10.5	12.5	7.0	12.5
2	Areas with certain circumstances						
3	Bridge building (b)	4.5	5.0	7.0	9.0	6.0	9.0
4	Forest plants / plants, plantation (b)	4.5	5.0	7.0	9.0	6.0	9.0
5	Road / highway / railroad (a)	8.0	9.0	11.0	15.0	10.0	15.0
6	Public square (a)	12.5	13.5	15.0	18.0	13.0	17.0
7	Other SUTT, Low Air line (SUTR), Medium Voltage Air Line (SUTM), Communication overhead line, antenna and cable car b)	3.0	4.0	5.0	8.5	6.0	7.0
8	The highest point of the mast at the position of the tide / highest water traffic (b)	3.0	4.0	6.0	8.5	6.0	10

The minimum clearance regulation is used as a buffer in areas that will be affected by land use change, if the construction of airways is realized. The planned land use change is predicted by considering the Minister of Energy and Mineral Resources Regulation No. 2 of 2019.

Land use changes from production forest and natural forest to shrublands, have been observed in areas affected by the height limit of stands. Shrublands, rice fields, fields, open land and water bodies are not affected by the space limitation policy; the relatively low vegetation only requires monitoring. Settlements in the channel corridor area have not undergone any changes, but it is necessary to monitor building height to ensure that requirements are being met.

The results of land use identification, in the airway corridor of the UCPS project plan, show that the impact of land changes in the UCPS project airway corridor occurs in forests and secondary forests, which will become bushes. Changes in land use will certainly have an impact on environmental parameters. Details of actual land and planned land use areas are presented in Figure 117.

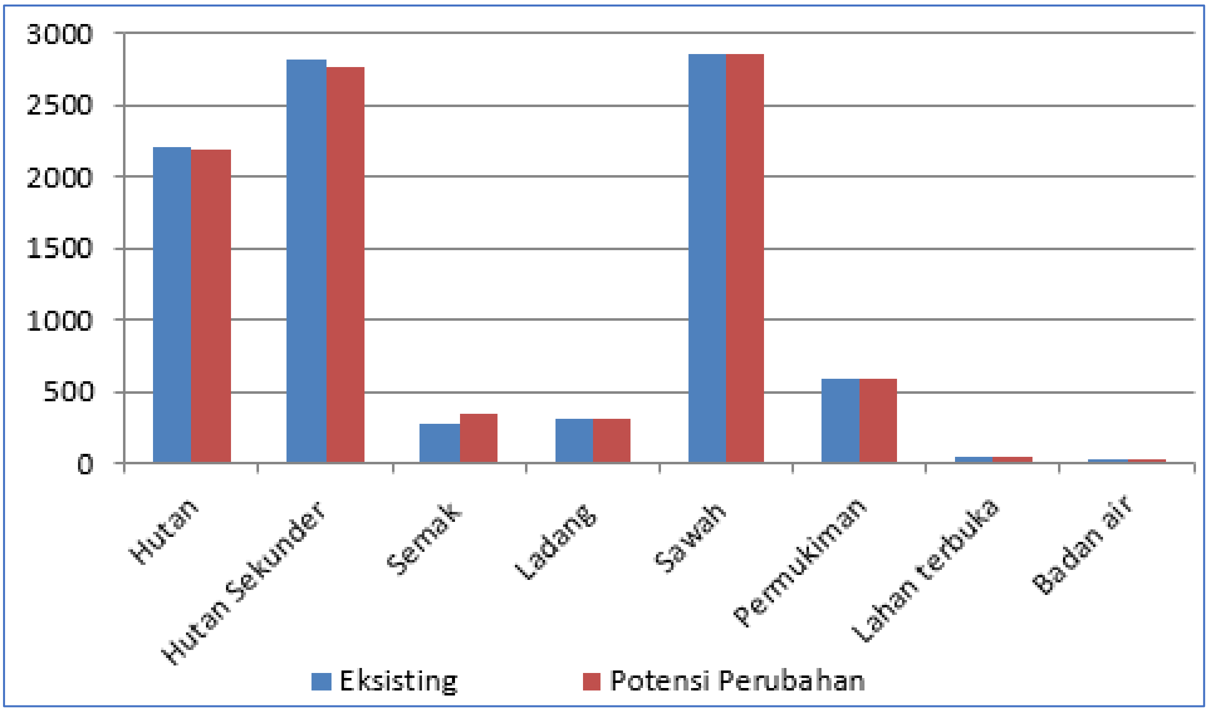

Figure 117. Land Use Change Graph in the 500 kV UCPS Transmission Line. Blue = existing land cover. Red = potential landcover following transmission line development. "Hutan" = forest; "Semak" = scrub; "Sawah" = wet rice field.

The results of the analysis show that the changes in land use in the airway corridor are forest to shrub (18.29 ha) and secondary forest to shrub (49.46 ha). Environmental parameters that have an impact on land use change are:

- Changes in surface runoff and erosion; surface runoff is calculated based on rainfall intensity, runoff coefficient and area. Changes in land use in the airway area affect the runoff coefficient value. The change in runoff coefficient for forest to shrub is 0.03 to 0.07 and 0.05 to 0.07 from secondary forest to shrub. Land use change also affects land erosion. Land erosion can be predicted by determining erosion potential, using the USLE (Universal Soil Lost Equation) method, with the parameters of rainfall, soil, slope, soil type and land use. Land use parameters are mainly concerned with the value of land use and respective management factors. Forest has a CP factor value of 0.005, secondary forest has a CP factor value of 0.3, while shrubs have a factor value of CP 0.5.
- Changes in land use affect food availability, especially if there is a change from agricultural to non-agricultural land (built-up land). Changing agricultural land to developed land will reduce regional food production. Changes in land use from vegetation to non-vegetation can reduce food reserves for livestock, and timber potential. The calculations show that the change in use of agricultural land to non-agricultural land does not occur as a result of the construction of an extra high voltage 500 kv overhead line. The visualization of the location of the 500 kV transmission line to be built is shown in the image below.

Figure 118. Visualization of 500 kV Transmission Line

Impact evaluation is carried out to estimate the potential significant impact of the activities on environmental parameters. The evaluation of land use impacts in the 500 kV UCPS transmission line corridor is shown in the table below.

Table 107. Land Use Impact Assessment from the 500 kV UCPS Transmission Line at the Operational Stage

Impact	Changes in land use, in the corridor of the 500kV transmission line, lead to changes in surface runoff and erosion-sedimentation.				
Impact Nature	Negative	Positive	Neutral		
	Change of forest land use to non-forest will increase surface runoff and, consequently, erosion-sedimentation.				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	Changes in land use in the corridor of the 500kV transmission line directly leads to changes in surface runoff and erosion-sedimentation.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	Changes in land use due to the construction of high-tension air have a permanent impact. As long as the airways are used, the rules for limiting height and distance will automatically apply.				
Impact Extent	Local	Regional	Global		
	Changes in land use will have impacts on runoff and erosion-sediment. The total area that will be impacted, however, is relatively small.				
Impact Magnitude	No change	Slight	Low	Medium	High
	The size of the impact that occurs from changes in land use in the airspace corridor ,with a total area of only 18.29 ha and 49.46 ha, respectively, compared to the total corridor area of 9093.3 ha, is relatively small, especially when compared to ecological units (watershed boundaries).				
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
	Based on the size of the impact, land use change has little impact on receptors at the watershed scale.				
Impact Severity	Slight	Low	Medium	High	Very High
	The small impact magnitude and low receptor sensitivity indicate that the impact severity is small (Slight).				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood / Inevitable
	The impact of changes in surface runoff and erosion-sedimentation, resulting from the construction of transmission networks had a medium likelihood of occurring.				
Significance	Negligible	Minor	Moderate	Major	Critical
	Slight impact severity, with medium likelihood, results in Negligible Significance.				

Based on the results of the scoping, it can be concluded that the impact of land use change in the 500 kV UCPS Transmission line is considered to be a negligible.

12.2.6 Visual Impact on Transmission Line

Visual impact analysis is carried out in the area around the Transmission Line, with reference to the Guideline for Landscape Character and Visual Impact Assessment (Center for Urban Design, 2020). The analysis stage begins by determining the Area of Interest (AoI), in accordance with the scope of the transmission line area that has been determined by PLN. The area around the transmission line is then analyzed, using a desk study, using remote sensing and modeling. Modeling is carried out to determine the visual observation point of the transmission line construction. The visualization of the transmission line modeling results is shown in Figure 119.

Figure 119. Visualization of UCPS Transmission Line Modeling Results

Field observations are made to determine environmental conditions and the effect of transmission line construction on views at several locations, especially densely populated areas and crowded centers. The aspects observed were:

- Topographical conditions of the region
- Ecological characteristics, such as land cover and various types of plants
- Community income from local natural resources, such as agricultural products, agriculture and tourist areas
- The area of cultural heritage and cultural customs that develops in the community
- Development plan for the study location area
- Accessibility from the main road to the points of transmission line development
- Settlement, demographics and community perceptions of transmission line development
- Center for growth of the crowd and transportation network
- Percentage of green open land cover and vegetation around residential/densely populated areas

(a) Construction Plan of Transmission line Tower on the distant hills

(b) Construction Plan of Transmission Line Tower on the hill, behind the settlement

(c) Transmission line Tower Construction Plan in community yards

Figure 120. Location of Visual Impact Observation on UCPS Transmission Line Construction Plan; (a) Low (b) Moderate (c) High

Observations were made at several points that represented the condition of the view of the transmission tower in the community. The following figure shows the visual impact on the planned location of the UCPS transmission line construction.

Observations at locations around the transmission line provide information about where the view of the receptors is disturbed and where not. These visual disturbances are classified as high (disturbed views), moderate (slightly disturbed view), and low (uninterrupted view).

The impact analysis on visual conditions around the project area, based on this classification, is shown in Figure 121.

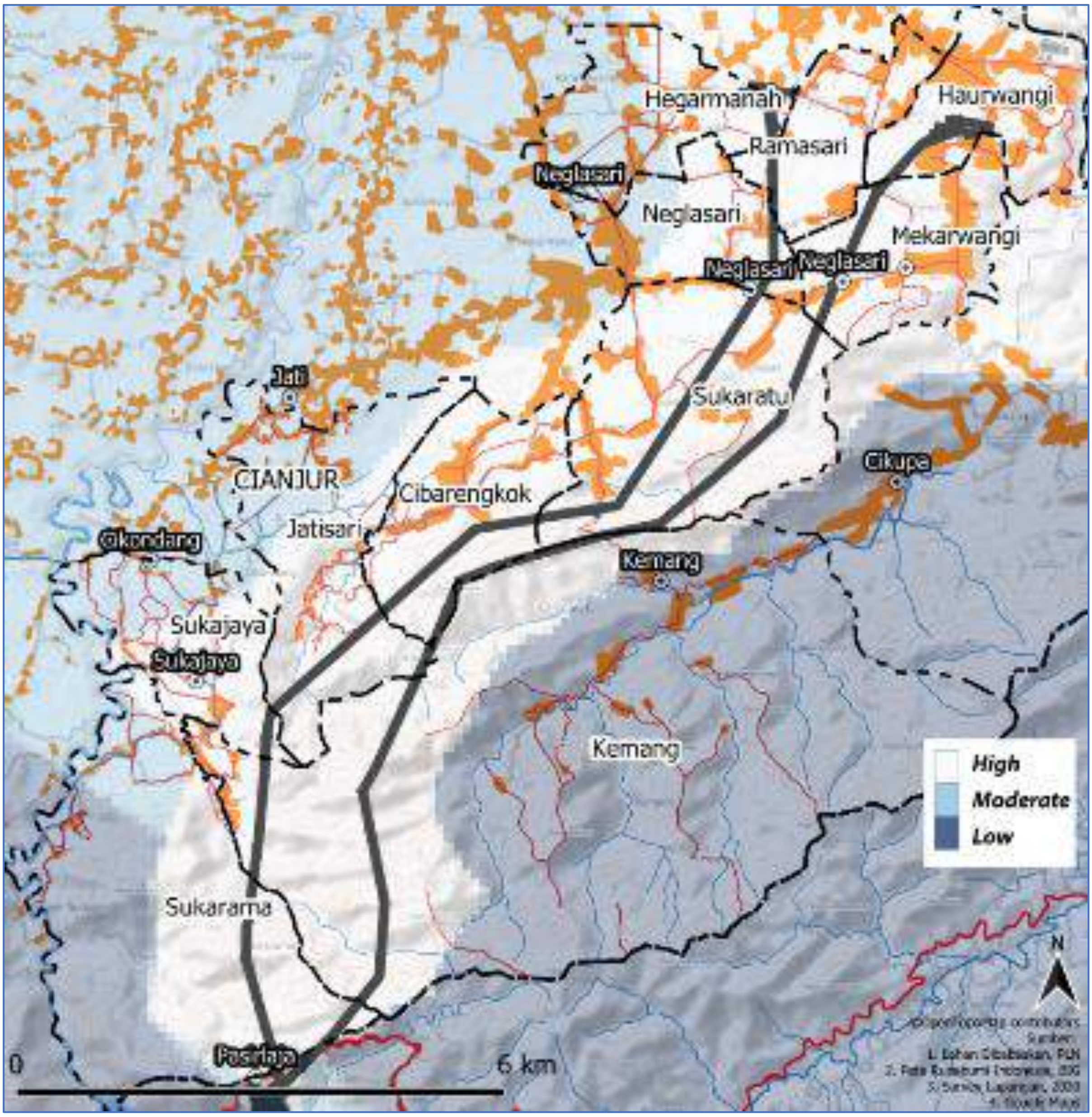

Figure 121. Distribution of Visual Conditions Observation Around the Transmission Line

Evaluation of the visual impact from the 500 kV UCPS transmission line is shown in Table 108.

Table 108. Visual Impact Assessment Due to the existence of the UCPS 500 kV Transmission Line

Impact	Disturbance of view due to the transmission lines.				
Impact Nature	Negative	Positive	Neutral		
	The presence of transmission lines can have a negative impact if they interfere with the view of humans as receptors.				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual

	The disruption of receptor visualization is the direct impact of the towers and cables which run along the transmission line.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	This impact is long-term because the transmission line will be used throughout the operation of the UCPS hydropower plant, but would cease if the project stopped.				
Impact Extent	Local	Regional	Global		
	The visual disturbance only affects locations around the 500 kV UCPS transmission line				
Impact Magnitude	No change	Slight	Low	Medium	High
	The results show that, from the east side of the transmission line, the level of visual disturbances due to the stretch of the transmission network is "low", due to being blocked by hills. Meanwhile, in the western part, most of the visual disturbances were "moderate". The transmission network is clearly visible in the northern part of this area because this area is a rice field area.				
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
	The sensitivity level of the visual disturbance receptors from the transmission network in the area is low.				
Impact Severity	Slight	Low	Medium	High	Very High
	The low impact magnitude and low receptor sensitivity indicate a Slight impact severity.				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood / Inevitable
	Visual disturbances due to high construction buildings rarely occur.				
Significance	Negligible	Minor	Moderate	Major	Critical
	Slight impact severity, with low likelihood, results in Negligible Significance.				

Based on the results of the visual impact assessment of the 500 kV transmission network, the results are negligible. Therefore, the impact can be ignored

12.2.7 Biodiversity

12.2.7.1 Deforestation and Forest Degradation through Agricultural Conversion

The main impact on vegetation is related to land clearing, especially for agricultural development (Table 109). No clear information is available on the history of land clearing in the area, but it is likely that this activity has been ongoing for a long time. Vegetation maps from 1950 show the highlands around Cisokan covered with natural forest, with lowland areas likely being used for community agriculture. A 1919 photo of the Cisokan River basin shows mostly forested slopes, and also provides an idea of what the original vegetation would have looked like. This information is crucial in terms of re-establishing native vegetation cover as a long-term management objective. However, there is likely to be some degree of degradation in forested slope areas. Since around the 1960s, deforestation has increased significantly, with little more than a few dozen hectares of forest remaining today.

Land use by communities had a significant impact on previously forested slope areas, mainly through slash-and-burn activities, with more permanent rice farming focused on the valley floor, adjacent to rivers. Cutting and burning of vegetation usually results in cutting down not only shrubs, but also forest trees, such as teak and pine. The shifting nature of agriculture has resulted in a patchworks of forest - with the best forest often on the steepest slopes most unsuitable for cultivation, surrounded by degraded forest, scrublands, and grasslands. Some dry rice is also planted on the slopes and some steep areas are planted with lemongrass, which thrives there. These community activities have had a major impact on production forest areas (under Perhutani management).

Table 109. Impact Assessment of Deforestation and Forest Degradation through Agricultural Conversion

Impact	Deforestation and forest degradation through agricultural conversion				
Impact Nature	Negative	Positive	Neutral		
	Loss of vegetation diversity, loss of food sources and habitat for wildlife				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	These impacts are considered to be cumulative because agricultural conversion acts together with other direct and indirect impacts (reservoir inundation and related forest loss, relocation of communities and associated land use change, and disturbance and hunting of wildlife.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	The impacts will be long-term.				
Impact Extent	Local	Regional	Global		
	The directly affected area is the community's cultivated land and forest patches, but impacts on biodiversity extend across the wider landscape.				
Impact Magnitude	No change	Slight	Low	Medium	High
	Several Perhutani forest lands on the hills of the Cirumamis, Cilengkong and Cisokan watersheds, were felled and burned by the people for agricultural purposes. During the felling and burning of the vegetation, not only are the wild bushes cut down and burned, but also forest trees such as teak and pine.				
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
	Land clearing by means of slash and burn is still ongoing, however, PLN and Perhutani will carry out revegetation which should offset some of these impacts. Nevertheless, wildlife will have medium-high receptor sensitivity to these impacts because of already very low population numbers.				
Impact Severity	Slight	Low	Medium	High	Very High
	Medium impact magnitude and medium-high receptor sensitivity indicate high impact severity.				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood / Inevitable
	Incidents continue to occur due to the absence of an adequate source of income for the community using the land				
Significance	Negligible	Minor	Moderate	Major	Critical
	The impact severity of high, with medium likelihood, resulted in Major Significance				

12.2.7.2 Hunting and Capturing Wild Animals

Communities are also a threat to local biodiversity due to hunting and fishing activities, and this may be difficult to control, especially if the market value of the species is high. Commercial collection primarily targets species such as pangolins. Various bird species are popular in the pet trade. The pet trade also affects some primates, particularly the slow loris which is in high demand in the Southeast Asian animal market, but other species such as the leaf monkey are also traded.

Hunting activities are more a form of recreation. However, there are also residents who sell the hunted wild boar meat to intermediary traders in Sukarama and Bojong Picung Village, to be sold in the Ciranjang area, Cianjur Regency. Residents in the Lembur Sawah / Serang

Block, and in the Langkob and Pamipiran areas stated that the number of wild boars is large in the forest area around UCPS. In fact, sometimes groups of wild boars enter the gardens near the settlement. Wild boars are also considered pests to their agricultural land, meaning that hunting of wild boar has become a common activity for residents.

The elders of Cimarel Village argued that hunting was a tradition. In ancient times, hunting was commonly practiced after Eid al-Fitr as a form of entertainment (*kariaan*). The animals that are hunted are deer (*Mengek*) and mouse deer (*Kancil/Peucang*). The game is slaughtered and eaten together with the community. One elder stated that, until the 1960's, this activity could still be done. However, nowadays it is very difficult to find deer, which has led to a decline in hunting.

Human-wildlife conflicts are also a threat to species, especially pigs and deer that eat agricultural crops. People consider these species to be pests and hunt or trap them, if they can. Indirectly, this also affects predators such as the Javan leopard, which, due to limited prey, is forced to eat dogs or other pets, with potentially fatal consequences for the leopard.

Communities hold traditional beliefs about the protection of certain species or forest areas but, given the rapid decline in forest cover over the last 6 decades and the general decline in the value of wildlife, these beliefs are notably less effective. However, long-term biodiversity management in the area should use traditional belief systems that help protect wildlife whenever possible.

The extent to which these hunting and collection activities will increase because of the project is unclear, but better access to the area and the presence of workers could increase demand and thus pressure on remaining wildlife.

Table 110. Impact Assessment of Wild Animal Hunting and Catching

Impact	Hunting and Capturing Wild Animals				
Impact Nature	Negative	Positive	Neutral		
	It is expected that without strong mitigation (biodiversity management, law enforcement etc.) there could be an increase in hunting and capturing pressure on wildlife.				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	Impacts are considered to be cumulative, driven by changing socio-economic conditions, land use changes, access to the area, presence of workers and other factors that could generate increased demand for wildlife.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	The hunting of wild boar by the Cimarel people is generally temporal. However, the hunting of these pest animals is currently very prevalent by residents from outside the hydropower plant area such as Sukarama, Bojong Picung and surrounding areas.				
Impact Extent	Local	Regional	Global		
	Impact occurs around the project site				
Impact Magnitude	No change	Slight	Low	Medium	High
	The loss of one type of animal which is a source of food for other types of animals encourages the entry of wild animals into the settlement in search of other food, which triggers conflict between humans and wild animals and further decreases the population of wild animals				
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
	The hunting of these pest animals is increasingly being carried out by residents from Hanjawar Village, Bojong Salam Village, Pamoyanan, and Cibaros, as well as hunter groups from the Cianjur area such as from the Sukarama, Bojong Picung and surrounding areas.				

Impact Severity	Slight	Low	Medium	High	Very High
	Medium impact magnitude and low-medium receptor sensitivity show medium impact severity.				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood / Inevitable
	Hunting and catching wild animals is still ongoing and is predicted to increase due to market demand and high economic value.				
Significance	Negligible	Minor	Moderate	Major	Critical
	The impact severity of medium, with medium likelihood, resulted in Minor-Moderate Significance.				

12.2.7.3 Increased Access and Development

The construction of an access road to the project area will facilitate the transportation of commodities, produced by shifting cultivation and agriculture, to nearby cities, thereby increasing the net income that can be obtained from agriculture. This could increase the demand for shifting cultivation areas, increasing pressure on the remaining forest. Better access could also attract migrant workers, increasing pressure on scarce land and wildlife. If not managed carefully, these changes will increase damage to vegetation and threaten biodiversity in the UCPS hydropower plant area. In addition, during forest clearing, easy access has the potential to facilitate the transportation of stolen timber.

Currently, PT. PLN (Persero) has established guard posts that regulate access traffic at several points of inspection roads adjacent to residential areas and protected forests, as control over BIA areas and protected forests. However, only those close to settlements were practical. A notice board regarding road use permits has also been erected, but only during the construction of the access road.

Various bulletin boards regarding hunting bans, and tree cutting bans near BIA and the working zone have been put in place and are generally in good condition. Socialization and cooperation with the community, regarding environmental conservation and management, has also been carried out, especially in 2015 and 2016. One of the socialization activities is "Socialization of Environmental Conservation in the BIA 14 Area", addressing people living in Cangkuang Village and its surroundings.

The results of the 2020 rapid survey show that local communities around the forest have a tendency to refrain from extracting resources from the forest because it was reported that one of the residents was arrested for violating the regulations regarding biodiversity conservation. However, due to economic encouragement, the risk is often taken. In the long term, this can be eliminated by implementing recommendations for harmonization of forest management in the UCPS area so that local people do not encroach upon new forest areas, but rather profit from the sale of agroforestry products.

The communities have an established history of managing forests sustainably, this needs to be incorporated into management strategies so that the community feels ownership and responsibility for efforts both in private and state forests. Efforts are needed to find harmony (harmonization) between related stakeholders to be able to manage forest areas in Cisokan properly, in this case PLN and Perhutani.

It is acknowledged that the conversion of forest land into agricultural land causes many problems such as decreased soil fertility, erosion, extinction of flora and fauna, floods, drought and even contributes to climate change. This problem is getting worse, in line with the increasing area of forest that is converted into other business land. Agroforestry is a collective term for land use systems and technology, which are planned to be implemented on one land unit by combining woody plants (trees, shrubs, palms, bamboo, etc.) with agricultural crops and / or animals (livestock) and / or fish, either at the same time or in turns to form ecological and economic interactions between the various components that exist.

The development of an agricultural commodity in an area must really consider the efficiency of farming. This means that with a certain level of production, minimal costs must be pursued so that it can be more profitable for farmers. This is because, in the era of free market globalization, only the products produced efficiently are able to compete, both in the domestic and international markets. Efficient farming can only be achieved by applying appropriate technology.

Before being distributed to users, a model must be developed and evaluated for its technical and financial feasibility. The model can be said to be effective if it meets the following criteria: (1) it is technically easy to do, (2) it is financially profitable, (3) it is socially and culturally accepted by the community, and (4) it does not damage the environment. Thus, economic feasibility is an absolute requirement for a model to be adopted by farmers.

Table 111. Impact Assessment of Increased Access and Development

Impact	Increased access and development in the area may lead to shifting of cultivation areas, and higher pressure on natural resources such as timber to be stolen.				
Impact Nature	Negative	Positive	Neutral		
	Loss and destruction of vegetation, reduced wildlife populations, threats to biodiversity				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	More land clearing and encroachment of previously difficult-to-reach areas due to easier access, further threats to vegetation and wildlife populations				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	In the long run, access to areas that were previously difficult to reach becomes easier, opening up opportunities for forest encroachment, thereby increasing threats to biodiversity				
Impact Extent	Local	Regional	Global		
	The impact was felt around the Cisokan hydropower area				
Impact Magnitude	No change	Slight	Low	Medium	High
	Development and accessibility can increase pressure on land and wildlife. If not managed carefully, these changes will increase damage to vegetation and threaten biodiversity				
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
	Impacts will be found on communities around UCPS, especially in areas traversed by access roads.				
Impact Severity	Slight	Low	Medium	High	Very High
	Low impact magnitude and medium receptor sensitivity show medium impact severity.				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood / Inevitable
	Ease of access will drive the community out of the area. The impetus will be heavier on increasing opportunities to earn a living outside the area, rather than on further encroachment into the forest because of the possibility of good FPF implementation.				
Significance	Negligible	Minor	Moderate	Major	Critical
	The medium impact severity, with low likelihood is of Minor Significance				

12.2.7.4 Risk Impact of Electrocution and Collision of Wildlife on the Transmission Line

At the operational stage, the transmission line has the potential to increase the risk of electrocution and collision occurring in wild animals. In tower areas with cables that are not completely insulated or in flow paths with open transformers, especially in areas around Tower 3-4, there is a risk of electrocuting wild animals. The cable span can further affect the potential for birds to be electrocuted. Further handling of the management of a safer transmission line is needed by paying attention to cables and transformers that pose a risk of electric shock to wild animals. Collision risks can be reduced by enduring cables and other structures are equipped with visual markers, and by periodically inspecting that cables are properly insulated all the way and operating at safe conditions.

Table 112. Impact Assessment of Occurrence Electric Shock and Collision Risks to the Wild Animals on the Transmission Line

Impact	Incidence of wild animals electrocuted or injured or killed through collision.				
Impact Nature	Negative	Positive	Neutral		
	Loss of biodiversity, reduced wildlife populations.				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	Electrocution of wild animals can occur directly if the cables or transformers in the transmission line are not properly insulated or if cables are too close. Injury or death can occur from birds flying into cables.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	Once constructed, the risks will be ongoing for the life of the project.				
Impact Extent	Local	Regional	Global		
	The impact will be along the transmission line route (15km).				
Impact Magnitude	No change	Slight	Low	Medium	High
	15km is not a significant distance, but the location, on ridges, and in areas where there may be migratory and threatened resident bird and other species, results in a magnitude of risk of medium.				
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
	Javan Hawk-eagles may be present in the project area of influence. There are few breeding pairs left and therefore they are very sensitive to any injury or death from collision or electrocution. It is to be determined whether they are at risk, following additional studies.				
Impact Severity	Slight	Low	Medium	High	Very High
	The medium impact magnitude and high receptor sensitivity show high potential impact severity.				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood / Inevitable
	Based on impacts elsewhere in the world, the likelihood of electrocution and / or collision is medium.				
Significance	Negligible	Minor	Moderate	Major	Critical
	The high impact severity, with medium likelihood, leads to Major Significance				

12.2.7.5 Revegetation of Buffer Areas

Buffer areas are needed around inundated areas for several reasons. First, due to the highly fluctuating water levels in the two dam areas, a safe zone was needed to ensure that no gardens or buildings in the area were potentially affected by water level fluctuations.

Management and revegetation efforts are carried out in the corridor and BIA areas in accordance with the management model in the BMP document.

Revegetation activities will maintain soil stability around the upper and lower dam reservoirs, this will have an impact on reducing the rate of erosion and sediment entering the reservoir. Revegetation locations in the buffer area around the upper dam and lower dam are shown in Figure 122.

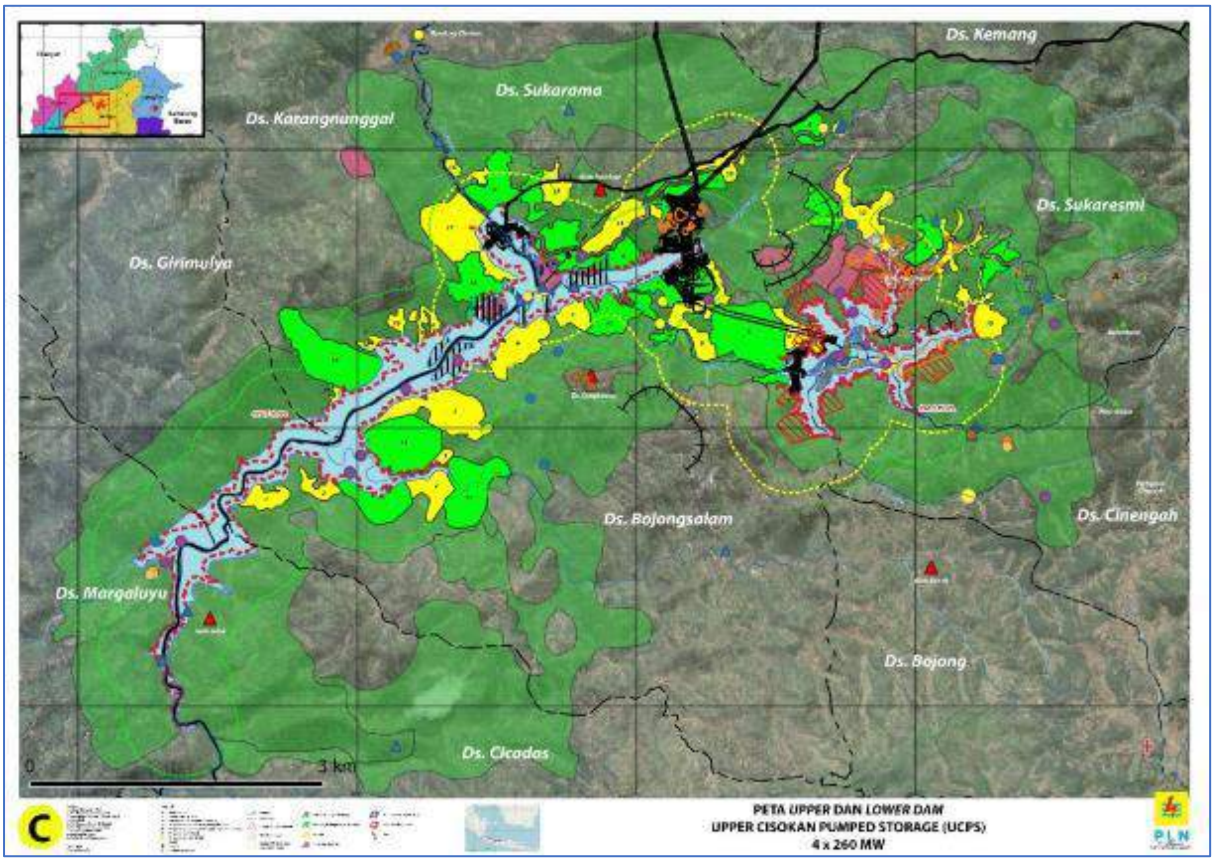

Figure 122. Buffer Area and Vegetation Restoration Targets in Reservoir Management during the Operational Stage

An assessment of the impact of revegetation in the buffer area at the operational stage of the UCPS dam is shown in Table 113.

Table 113. Assessment of the impact of revegetation on buffer areas at the operational stage of UCPS

Impact	Effective revegetation leads to maintained soil stability, improved habitat and reduced potential for rate of erosion sedimentation resulting from locations around inundation				
Impact Nature	Negative	Positive	Neutral		
	Revegetation of the buffer area is a positive impact because it has the potential to improve habitat around the upper and lower dams, and reduce the potential for sedimentation.				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	Revegetation will have a direct impact on improving environmental conditions around the upper and lower dams. In addition, buffer zone management can reduce land access to the weir body, so that the weir body will be safe from direct contamination and reduce the risk of accidents.				
	Temporary	Short-term	Long-term	Permanent	

Impact Duration	Revegetation carried out around the upper and lower dam locations will improve the environmental conditions around UCPS. Improvements to environmental conditions will take place throughout UCPS operations.				
Impact Extent	Local	Regional	Global		
	The impact of revegetation activities will be felt directly on a local scale around the upper and lower dams.				
Impact Magnitude	No change	Slight	Low	Medium	High
	The area where revegetation will be carried out around the upper and lower dam is ± 585.3 ha , therefore, the environmental improvements around UCPS can have quite a big impact.				
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
	Receptors for the impact of revegetation in the buffer area are the people living around UCPS. With revegetation, the increase in temperature can be controlled in the area so that it does not have a negative impact on the local community.				
Impact Severity	Slight	Low	Medium	High	Very High
	Medium impact magnitude and medium receptor sensitivity showed medium impact severity.				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood / Inevitable
	Environmental improvement in terms of micro-climatic conditions and reduction of sediment that enters reservoirs are certain impacts when revegetation is carried out in the buffer area.				
Significance	Negligible	Minor	Moderate	Major Positive	Critical
	The impact severity of medium with medium likelihood leads to major positive significance				

Revegetation in the buffer areas around the upper and lower dams can have a major impact, especially when viewed from the microclimate conditions and the reduction of sediment entering the reservoir, both in the upper and lower dams. Another positive impact is that revegetation of the buffer area limits human access to the reservoir, thereby minimizing accidents that occur in the reservoir. The positive impact of buffer zone revegetation indicates that this activity can be carried out by monitoring and evaluating activities in accordance with the expected objectives.

12.2.7.6 Conclusions on ESS6 Critical and Natural Habitat net loss

The conclusion from the Critical Habitat assessment is that three species occurring in UCPS are likely to pass the thresholds for Critical Habitat. As no viable alternatives have been identified for the project, ESS 6 requires that:

1. the impacts will not lead to measurable net reduction or negative change in those biodiversity values for which the critical habitat was designated;
2. the project is not anticipated to lead to a net reduction in the population of any Critically Endangered, Endangered, or restricted-range species, over a reasonable time period;
3. the project will not involve significant conversion or significant degradation of critical habitats; and
4. the project's mitigation strategy will be designed to achieve net gains of those biodiversity values for which the critical habitat was designated.

Before determining what net losses and net gains mean in the UCPS landscape, a clearer description is needed of the key ecological elements of the landscape that maintain the species triggering the Critical Habitat threshold. The UCPS landscape is strongly human-modified with a long history of conversion of forests to agricultural fields, and also maintenance of forest-type conditions in agroforestry areas. The terrestrial landscape is, therefore, both a Critical Habitat and a Modified Habitat. The agroforestry areas are concentrated in the BIAs identified in UCPS and other forest patches, mostly on steep slopes where agriculture is difficult (except towards hill ridges, which provide access from above). The overall landscape of 3,452 ha accounts for ca. 66% of agroforest areas where trees and tree crops are cultivated for human use, but which also provide important biodiversity.

Species like the Javan Gibbon, Grizzled Leaf Monkey, and Slow Loris depend on the agroforestry elements in the landscape and their ecological connections. The total area required for the UCPS is ca. 400 ha, with an additional 100 ha of direct impacts along the transmission line.

Indirect impacts are more difficult to estimate. They consist of a range of construction related impacts, such as noise, dust, disturbance by traffic, river sedimentation, as well as social factors, such as the relocation of people that could result in greater pressure on remaining forests. We do not currently have the data to more accurately measure the indirect impacts, especially on the forested parts of the landscape and its biodiversity, and we assume a conservative 0.5 km buffer around the total area of UCPS as the area indirectly impacted by project developments. This is based on studies that indicated a linear decrease of impacts (e.g., hunting, disturbance, deforestation) from roads and other project infrastructure (Clayton et al. 1997, Laurance et al. 2006, CarbonTropic 2017). The area of indirect impacts is currently estimated at 2,629 ha, and more precise mapping is ongoing.

Table 114. Estimated areas of direct and indirect impacts, parts of which are Critical Habitat.

Area	Direct Impacts (ha)	Indirect Impacts (ha)
UCPS	400	2,288
Transmission Line	100	341
Estimated total impacts	500	2,629
Estimated total impacts based on counterfactual	500	1,867

Referring to ESS 6, the habitat around the transmission line sampling points is dominated by modified habitats because there is much human interference, and the transmission line project site is not in a protected area. Several species that trigger Critical Habitat were found in forested parts of the transmission line route. Table 114 provides an overall indication of direct and indirect impacts from reservoir and transmission line development. More precise mapping is required to determine which areas meet the criteria for Critical Habitat. It is clear that the species that trigger Critical Habitat thresholds area able to use different elements in these kinds of human-dominated landscapes.

12.2.8 Greenhouse Gas Emissions

The assessment of greenhouse gas emissions is currently underway as part of the economic analysis. Preliminary results are presented in this section. The emissions analysis is linked to the economic analysis since the function of the pumped storage system in the Java-Bali grid will influence the use of both fossil fuels and renewable electricity generation.

As discussed, the economic evaluation of UCPS is taking into account two factors:

1. the energy arbitrage (ability to manage the generation mix based on market price) and
2. value of the ancillary services the UCPS provides to the Java-Bali grid.

The value of arbitrage is well-understood and represents the ability to shift low-cost generation to peak periods, thereby reducing the costs of meeting demand. As the share of renewables in the Java-Bali grid increases, the UCPS also provides a means to use 'excess' renewable energy to pump water to the upper reservoir to 'store' the energy for use at a different time of day, thereby reducing the risk of renewables curtailment due to insufficient demand or inadequate transmission capacity.

As discussed in Section 1.3 there are many ancillary services UCPS will provide to the grid, such as:

- Regulation. These are reserves held to automatically respond to instantaneous active power imbalance and stabilize system frequency. These can be provided by adjusting generation levels, pumping loads or interruptible loads.
- Spinning Reserves. These are generating resources that are not operating at full capacity and are available to ramp output up or down.
- Replacement (long-term reserve). This is idle capacity that is available to be brought online within time frames longer than regulation or spinning reserves.

These services and energy arbitrage can assist PLN to operate the Java-Bali grid in a way that optimizes the use of renewable energy and ensure more renewable energy can be connected to the grid without affecting grid stability. This optimization will contribute to overall greenhouse gas emissions reductions from the grid compared to the counterfactual scenario.

Least-cost expansion planning: A least-cost system expansion plan has been modelled for the next 20 years of energy requirements (as a free optimization, i.e., without any fixed targets such as minimum renewable energy penetration); within the model, capacity was added and the system operated only to minimize the present value of total system costs subject to reliability and reserve constraints. UCPS was a candidate in this least-cost planning exercise.

The total value of the project was then calculated as the sum of the ancillary service value, plus the energy arbitrage and capacity value.

Preliminary Results: The Long Term Least Cost Development Planning outputs confirms that UCPS project is part of the least cost solution, with an optimal commissioning date in 2028. The storage capacity of UCPS also allows for a significant increase of solar penetration in the system (40 GW), and a decrease of coal generation starting from 2028 (Figure 123).

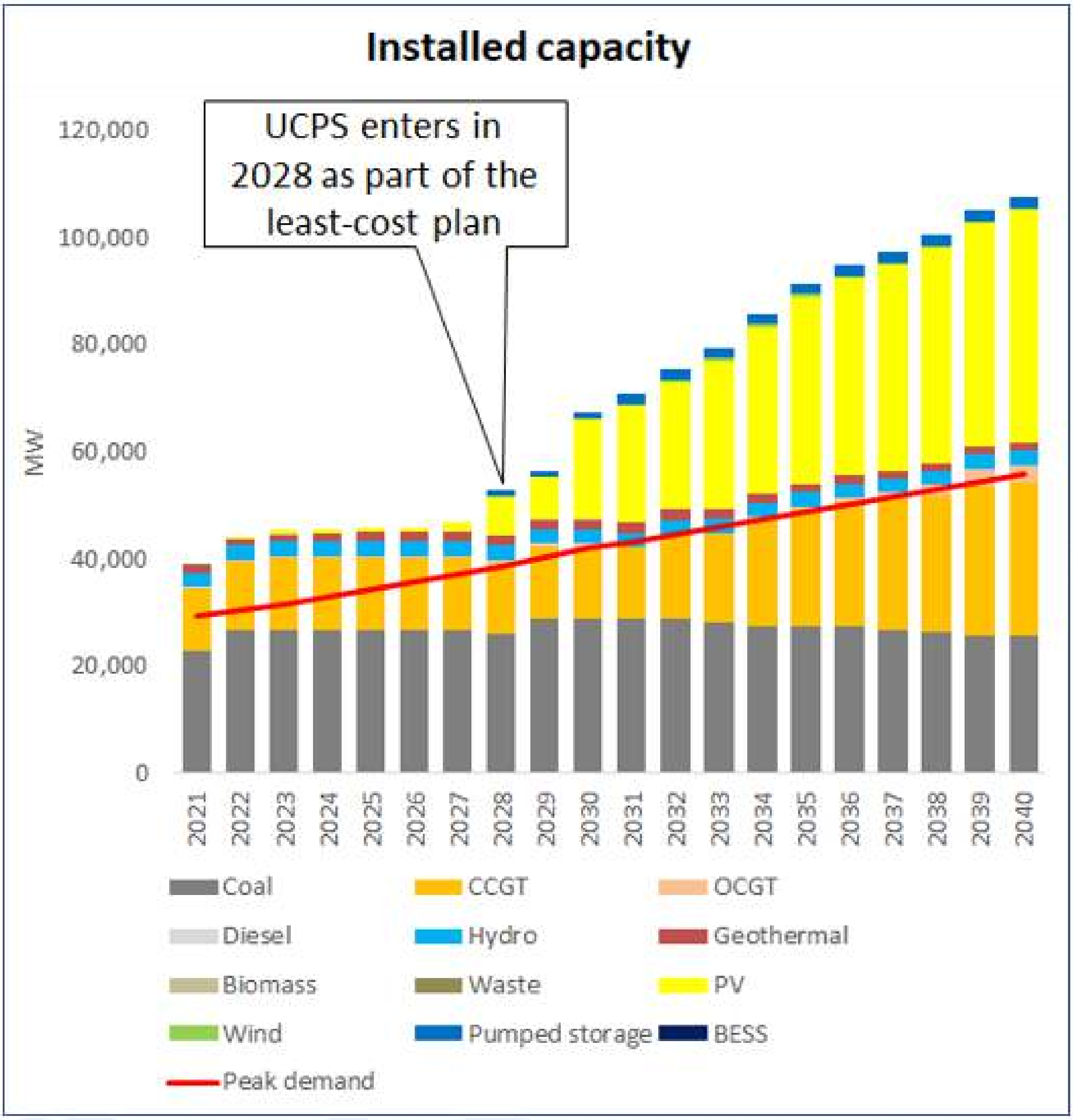

Figure 123. Long Term Development Plan for Java-Bali System

Climate Assessment: Once the Long Term Least Cost Planning is completed, carbon emissions of the system can be calculated, as well as the evolution of the system carbon intensity over time.

On the basis of this Long-Term Development Plan, carbon emissions of the entire system as well as the systems emission intensity have been calculated. The modelling shows that intensity will decrease from about 0.75 tons of CO_2/MWh in 2028 to about 0.55 tons of CO_2/MWh in 2040. Figure 124 below shows the evolution of the systems emission intensity from 2021 to 2040.

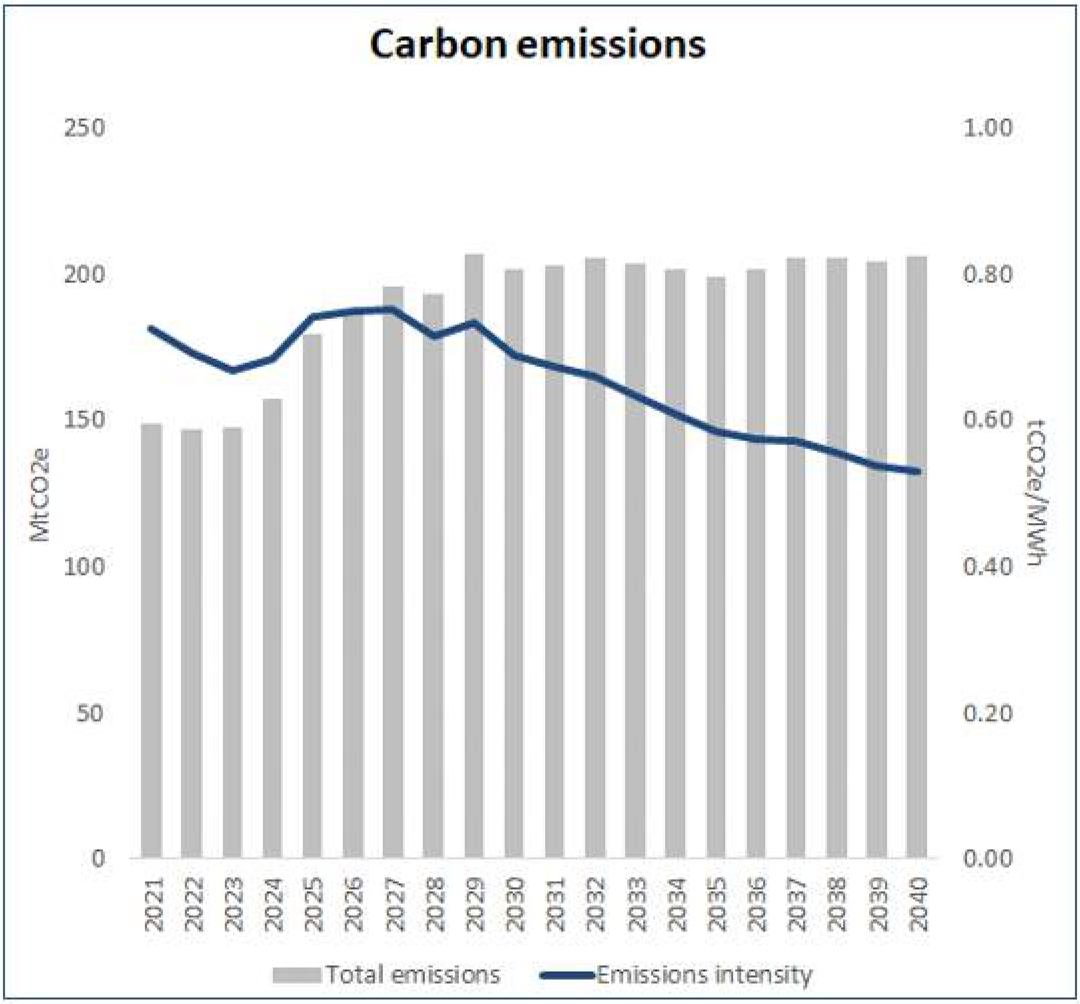

Figure 124. Java-Bali System Carbon Emission Intensity

12.2.9 Noise and Vibration

The turbines and generators which will generate noise and vibrations are located at a very deep depth (294m) within the underground power house. During the operation mode, from the outside (environmental area) it shall be very difficult to detect noise and vibrations. The noise level is predicted to be lower than 50 dB and the vibrations by the turbines and generators that are of 50 hertz shall be less than <1mm/sec. This condition according to Environmental standards issued by Ministry No KEP-49/MENLH/11/1996 shall have no environmental or social risk.

12.3 Social Impacts During Operational Stage

The ESIA surveys reveal potentials for more development and opportunities during the operational phase of the project. No major negative social impacts are anticipated, but there were some concerns expressed, particularly related to public health along the reservoir and under or near the transmission lines.

Shifting livelihood strategies will change once communities need to rely more on agroforestry and income from perennial crops, rather than annuals, as reforestation of the area proceeds.

12.3.1 Developments along the access road by immigrants

As reported in the 2019 Environmental Management Plan (RKL) and Environmental Monitoring Plan (RPL) Implementation Report, the environmental development around the new road access (new road) at the time of monitoring was the emergence of a number of community economic activities such as food stalls, inns, shops, grocery, motorbike washing shops, and mini fuel retailers around the location of the activity. It is likely that the new access road will lead to increased settlements in the area, given the active economic activity. After the Saguling road was built, many families had the potential to move to and inhabit the area around the road owned by PLN.

Upgrading old roads, and constructing new roads, will help local communities gain better access to markets and services outside the region to the east.

Table 115. Impact Assessment of Development Along the Access Road by Immigrants

Impact	The emergence of development along the main road.				
Impact Nature	Negative	Positive	Neutral		
	Construction along the access road can have a positive impact on communities in the area.				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	The impact on the location will be directly felt by the community				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	Impacts are long-term because they may occur during activities				
Impact Extent	Local	Regional	Global		
	The impact area is local because it only covers the area around the new road access				
Impact Magnitude	No change	Slight	Low	Medium	High
	The potential for adverse impacts on the community is low, because the area is well developed and has a high population.				
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
	It is predicted that the social changes around the main road will be at the Low-medium level. The main road will generate a lot of potential for development and communities building settlements in the area.				
Impact Severity	Slight	Low	Medium	High	Very High
	The combination of low-medium impact magnitude and Low Receptor Sensitivity categorizes the impact severity as low.				
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood / Inevitable
	The predicted impact likelihood is at a low level.				
Significance	Negligible	Minor	Moderate	Major	Critical
	The combination of Low Likelihood and Low Severity leads to Negligible Significance.				

12.3.2 Electric and Magnetic Fields (EMF) of the Transmission Line

The 500 kV PLTA transmission line is administratively located in the Rongga District, West Bandung Regency and Bojongpicung and Haurwangi Districts, Cianjur Regency. In this area there are several residents whose areas are crossed by transmission line, especially in the villages of Sukajaya, Jatisari, Cibarengkok, Sukaratu, Neglasari, Mekarwangi, Ramasari, and Haurwangi.

The transmission lines at these locations has the potential to have an impact on the health of people who live or work near the transmission network, by means of electric and magnetic fields from the transmission network. The electric and magnetic fields (EMF) in Indonesia have clear regulations, with appropriate distance settings for objects and people. The Transmission Network Management Plan provides for regular EMF monitoring efforts to ensure transmission lines are constructed to national standards. Complaints regarding health problems or other impacts can be submitted through the PLN complaint service.

The report on the Implementation of the Environmental Management Plan (RKL) and the Environmental Monitoring Plan (RPL) of the 500 kV transmission shows a trend of increasing public knowledge every year, and 100% of respondents are aware of the Cisokan UCPS project activities. Recent perceptions of health data (2019) show 30% of the public are concerned about the health impacts of transmission lines. Meanwhile, 9% of the community are concerned about compensation related to land acquisition. This concern is made clear in the results of the 2020 survey of the community, which stated that there has been no further outreach by PLN regarding public health issues around transmission lines, leaving people worried about the impact of high voltage transmission lines.

Table 116. Impact Assessment of Transmission Line on Health at the Operational Stage

Impact	Impact of transmission line electro-magnetic radiation on community health during operations				
Nature of Impact	Negative	Positive	Neutral		
	The impact is negative.				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	Electro-magnetic radiation during operations is immediate.				
Duration of Impact	Temporary	Short-term	Long-term	Permanent	
	The impact will be felt for the long term				
Impact Range	Local	Regional	Global		
	The extent of the impact will be local, limited to the area around the transmission line.				
Magnitude	No changes	Slight	Low	Medium	High
	The magnitude of the impact is low because the electromagnetic radiation is designed to be below the WHO maximum level.				
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
	The sensitivity of the receptors is Low-medium because the transmission line area predominantly passes through mixed gardens and rice fields.				
Impact severity	Slight	Low	Medium	High	Very high
	The combination of Low Magnitude and Low-Medium receptor sensitivity categorizes the impact severity as Low.				
Possibility	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood /Inevitable
	This event does not appear to have occurred at some point during the operation and there has been no health data regarding the impact of previous transmission line operations.				
Significance	Negligible	Minor	Moderate	Major	Critical
	The combination of Unlikely Probability and Low Severity leads to Negligible Significance.				

Although the significance of the impact can be neglected, it is necessary to educate the public about the impact of the transmission line on health. It is necessary to check the amount of electromagnetic radiation regularly along the transmission line.

Impact Mitigation

There is a potential impact on people living or working near the transmission network in the form of the impact of electric and magnetic fields from the transmission network, which can have an impact on health or damage to electrical equipment.

Mitigation:

1. Education is needed to the public about the impact of transmission lines on health.
2. Check the amount of electromagnetic radiation regularly along the transmission line

12.3.3 Water-borne Diseases

Reservoirs can cause waterborne diseases. These diseases are caused by pathogenic microorganisms that are directly transmitted when consuming contaminated water or indirectly by vectors of parasitic microorganisms that can infect the human body (e.g., animals which use water as a habitat in their life cycle). The people in the area use the water from wells and springs or small rivers found in the area for their household purposes.

Table 117. Top Ten Diseases Around the Project Area. Source: (PLN, 2011b)

No.	Disease	Percentage
1	Non-pneumonia upper respiratory tract infection	33%
2	Dermatitis	18%
3	Rheumatism	10%
4	Gastritis	9%
5	Diarrhea	9%
6	Hypertension	6%
7	fever *typhoid*	6%
8	Upper Respiratory Infection	3%
9	Conjunctivitis	3%
10	Dental caries	2%

The Upper Cisokan hydropower project will construct the upper and lower reservoirs with relatively small land and volume. There are potential impacts caused by the two reservoirs in the form of water-borne diseases (dysentery, cholera, typhoid fever, etc.) which can infect the surrounding population when people use the reservoir water for household purposes. Based on the 2010 AMDAL study, diarrhea and typhoid fever are among the top ten diseases found in the project area (Table 117). Thus, without mitigation measures, reservoirs will not be safe to use directly, due to the potential for waterborne diseases.

Communities are prohibited from entering the reservoir. Buffer areas around the boundary are designed to protect community safety from water level fluctuations. This project will provide clean water and several MCK facilities (bathing, washing, toilet) for residents around the reservoir or catchment area if necessary. This will prevent the surrounding community from using the reservoir water for household purposes, thereby reducing the potential for the spread of waterborne diseases.

Animals that use water for their life cycle may be affected by reservoirs, such as mosquitoes which can transmit malaria and snails which can transmit schistosomes. Fortunately, these diseases are rarely reported in the area. This project is relatively close to Cirata Reservoir (built in 1987) and Saguling Reservoir (built in 1985) for which there were no reports of the diseases. The fluctuation of the water level and the daily reversal of water with high discharge will also create conditions for controlling the infectious disease or its vector animals.

12.4 Occupational Health and Safety

The operation (including inundation) phase of the UCPS involve high-risk work activities, which must be managed through the implementation of an Occupational Health and Safety Management System as part of overall plant operations. Similar systems should be in place for transmission line operations and maintenance.

The OHS system will be implemented in accordance with the provisions of the laws and regulations regulated in Indonesia, which are in line with the International Labor Organization (ILO) requirements. In addition, according to ESS 2, the OHS measures will be designed and implemented to address the following:

- Indonesian Laws and regulations related to OHS, The World Bank Group EHS Guidelines Good Practice Note Environmental, Health and Safety Approaches for Hydropower Projects and other Good International Industry Practice for occupational health and safety.
- Identification of potential hazards to project workers, particularly those that may be life-threatening.
- Provision of preventive and protective measures, including modification, substitution, or elimination of hazardous conditions or substances.
- Training of project workers and maintenance of training records.
- Documentation and reporting of occupational accidents, diseases, and incidents.
- Emergency prevention and preparedness and response arrangements to emergency situations, including coordination with the Emergency Preparedness and Response measures established under ESS 4.
- Remedies or compensation for adverse impacts such as occupational injuries, deaths, disability, and disease. Such measures should take into account, as applicable, the wage level and age of the project worker, the degree of the adverse impact, and the number and age of dependents concerned.

The most significant Occupational Health and Safety (OHS) hazards associated with hydropower projects occur during the inundation and operational phase include activities which carry an extremely high risk for workers. These activities carry an elevated risk of injury or fatality if not managed adequately, these activities are:

- Vehicle incidents driving to, from and around the site.
- Working in confined spaces.
- Working underground.
- Working with electricity / electrical hazards.
- Exposure to noise.
- EMF exposure.
- Working at heights (transmission line, dam areas).
- Working near water (including during periods of drawdown or filling).

- Exposure to natural disasters and emergency events.

The Hierarchy of Controls pyramid will form the foundation by which safety risks and hazards are managed and controlled. The most effective measure is elimination/substitution, followed by engineering controls, administrative and work practice controls and finally PPE, as the least effective, at the bottom.

The controls are discussed below:

- Elimination/substitution: The best way to deal with a safety hazard is to eliminate it altogether by preventing exposure to the hazard before it even occurs. In substitution, one seeks to permanently reduce the risk by substituting a less hazardous material or reduction of system energy. These are process design solutions that require a permanent change to how a job is performed.
- Engineering controls: Changing the structure of the work area to reduce exposure to hazards, using safety devices or barriers. An example would be to place a high fence around a dangerous location to prevent access.
- Administrative and work practice controls: Implementing procedures that require workers to do things to reduce their exposure to a risk. A lockout/tagout program is an example of an administrative control. Set expectations that workers will engage in safe work practices. Another example is the use of warning signs, sirens and alarms.
- Personal protective equipment (PPE): Make sure employees wear the proper protective clothing, gloves and eyeglasses for the job. Examples are safety goggles, respirators, fall protection and hearing protection.

Mitigation

All contractors are required to ensure that the Health, Safety, and Environmental (HSE) risks are identified for their direct employees and sub-contractors. Each Contractor will develop an Occupational Health and Safety Plan that will cover all of the above hazards and risks to safeguard the health and safety of, in particular, the local workers who are likely to be less experienced in this area.

The OHS Plan should be based on applicable Indonesian Laws and Regulations, Good Practice Note Environmental, Health and Safety Approaches for Hydropower Projects, World Bank Group EHS Guidelines as well ESS 2, and will cover the following:

- Clearly delineate the scope of their control and responsibilities for worker health and safety, in terms of location(s) on site and activities within their control.
- The Contractor will prioritize worker health and safety standards such as preparing SOPs for each type of activity, conducting regular health and safety training and briefings (in the local languages) before the implementation of the activities and compulsory use of personal protective equipment (PPE).
- The Contractors and Supervision Engineers must have sufficient staff and resources to manage health and safety, including qualified and trained staff, staff with adequate managerial authority to control hazards and risks, suitable budgets, appropriate equipment, controls and PPE and access to all Project areas to assess and supervise healthy and safe work practices.
- Worker standards to be aligned with national requirements and ESS2 requirements for health and safety during inundation and operations, along with inductions, training refreshers and inspections. Each individual will be personally assessed for

competency and only allowed to work in areas where they have the required competency. On the job training and tracking of competency will be a continuous part of supervision of staff.

- Specific measures will be necessary to maintain staff health and wellbeing while working and being accommodated on site, including access to clean drinking water, clean and effective sanitation, avoiding overcrowding, adequate and clean food, recreation, health services, effective and appropriate PPE and other matters.
- The Contractors will develop and widely communicate and enforce its "Golden Health and Safety Rules" and create a safety culture.
- Strict Occupational Health and Safety requirements will be embedded in the Bid Documents Contractor's contract as per the World Bank Standard Procurement Documents, to ensure risk management, occupational injuries, worker rights, deaths, disability and diseases are managed as per the ESMP, ESS2 and GIIP.
- The Supervision Engineer and Contractor will undertake their own daily audits with H&S inspectors responsible for monitoring behaviours and correcting where required.
- Should non-compliance repeatedly occur a zero-tolerance approach will be adopted by PLN and enforced on the Contractor by the Supervision Engineer.
- Detailed records of near misses and incidents must be kept and used for continuous improvement purposes.
- Each Contractor will establish and implement a Worker Grievance Mechanism that will be accessible for all workers and sub-contractors to report issues (a confidential option should be provided). When complaints are submitted, the Contractor will undertake an immediate investigation. The Supervision Engineer will oversee the Grievance Mechanism and support the resolution where required.
- Emergency response and incident management procedures with prevention and early warning procedures, preparation, response and recovery from emergencies, including natural disasters, disease outbreaks, conflict or social unrest, pollution incidents and injury and fatality incident management.

Table 118. Impact Assessment High Risk Inundation/Operational Activities

Impact	The impact on workers is illness, injury, or fatality from high-risk activities (working at height, near water, in confined spaces and underground, noise sources, with electricity)				
Nature of Impact	Negative	Positive	Neutral		
	The potential impact on workers conducting high risk activities or activities in high risk environments is illness, injury or fatality.				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	Workers are directly exposed to hazards and will be directly impacted by illness, injury or fatality. Their families will be indirectly impacted.				
Duration of Impact	Temporary	Short-term	Long-term	Permanent	
	The exposure to risk will be long term as the hazards will exist during the entire operations phase. The impact (illness, injury, death) will be permanent.				
Impact Range	Local	Regional	Global		
	The exposure of risk will be limited to power station and grid network workers.				

Magnitude	No changes	Slight	Low	Moderate	High
	Has the potential to impact tens to hundreds of workers over the lifetime of the scheme and grid network operation.				
Receptor Sensitivity	Low	Low-Moderate	Moderate	Medium-High	High
	All workers are vulnerable to hazards.				
Impact severity	Slight	Low	Moderate	High	Very high
	The combination of High Magnitude and High Receptor Sensitivity the impact severity is deemed Very High.				
Possibility	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood/Inevitable
	There is a low likelihood that the most severe impact, such as fatality, may occur on the transmission line or power station / dam locations.				
Significance	Negligible	Minor	Moderate	Major	Critical
	The combination of Very High Severity and Low Likelihood leads to Major Significance for the operational phase of the project. To manage the risk health and safety must be prioritized by PLN and their contractors and with proper implementation, regular monitoring and continuous improvement.				

12.5 Dam Safety

The safety of the dam and associated structures, as well as the workers and the downstream communities, is a critical part of the design process, construction and operational procedures. As discussed in Section 4.1, the detailed design, bid documents, prequalification of bidders and the selection of the contractor have been supervised by the Project Review Panel, made up of dam and geotechnical experts, during the period of 2012 to 2017. At the time, the retention and use of the panel was compliant with the World Bank safeguards policy, OP.37 Safety of Dams. The panel signed off on the updated design, bid documents and the prequalification of the Contractor for Lot1a Upper and Lower Dams, and Lot 1b Waterways, Power House, Switchyard and Buildings. PLN propose to engage a new panel for the updated UCPS project, to assist in the supervision of construction, reservoir filling and commissioning, and the start of operations. The panel will also be involved in the review of dam safety documents. The Panel of Experts will be established by PLN in an acceptable manner to the Bank by the project effective date.

Dam structures and outlets have been designed to the International Commission on Large Dams (ICOLD) seismic standards. Dam structures and spillways have been designed to the 1/10,000 year flood return interval, as per the ICOLD standards, and the Indonesian government regulation regarding planned flood design discharge for dam structures, power generation and similar uses, based on SNI No. 2415:2016. Bottom outlets are designed to quickly release water in a controlled manner in cases where the dam structures are at risk of failure.

PLN has prepared: 1) Construction Supervision and Quality Assurance Plan, ii) Instrumentation Plan, iii) Preliminary Operation and Maintenance Plan, and iv) Broad Framework for Emergency Preparedness Plan. The CSQAP has been prepared as TOR for the construction Supervision Engineer and further detailed plans have been prepared by the consultant and contractor. Instrumentation plan has been prepared as part of the bidding documents. Whilst the preliminary O&M Plan and broad framework have been prepared, the full-fledged O&M Plan and EPP will be prepared by PLN and submitted to the Bank and Panel of Experts no less than 6 and 12 months prior to the initiation of the first reservoir filling.

12.6 Cumulative Impacts

CIA screening and analysis was undertaken in 2020 in accordance with the IFC Good Practice Handbook for Cumulative Impact Assessment and Management. The screening and analysis were retrospective because the majority of consultation, baseline assessment and impact assessment has been done over a number of years under the previous UCPS Project and the preparation of the AMDAL. This section summarizes the process and outputs.

The Good Practice Handbook defines CIA as the process of (a) analyzing the potential impacts and risks of proposed developments in the context of the potential effects of other human activities and natural environmental and social external drivers on the chosen VECs over time, and (b) proposing concrete measures to avoid, reduce, or mitigate such cumulative impacts and risk to the extent possible.

The objectives of the study were to understand the cumulative impacts on values within the Cisokan River and Citarum River from a number of hydropower schemes and dams and agricultural irrigation water demand and on the land use changes and conversion of habitat in the catchment.

Analytical outcomes

Step 1 – VEC's, spatial and temporal boundaries.

VEC's were identified from the extensive baseline environmental and social study work within the project area of influence and using literature review and IBAT screening tools for the broader Java context. Iterative processes of identifying sensitive VECs, assessing project impacts, spatial and temporal boundaries and cumulative impacts were done until the list of VECs were confirmed (refer Table 119).

Screening questions were considered:

a. Will the UCPS affect this VEC?

b. Would other identified projects/stressors in the area potentially affect this VEC cumulatively within the spatial boundary?

c. Would the impacts be potentially significant?

Several terrestrial mammalian species are identified as VECs because of the significant cumulative impacts of the UCPS and the existing rates of habitat conversion and degradation in the area. No fish or aquatic species met the conditions for VEC because those identified through field work and desk-based screening were not sensitive to the barrier and reservoir impacts from the Project. One bird species has been identified as a VEC, Javan Hawk-eagle, based on the potential collision or habitat degradation risks from the transmission line. The nature and scale project impacts are not yet confirmed because the presence and number of individuals in the area are uncertain. Due to the endangered status, even a low number of injury or mortality incidences on the transmission line could affect the population viability.

Only one social/economic VEC was confirmed; the Cihea Irrigation Scheme. The scheme is sensitive to water availability, but while the UCPS will not have a significant impact on water availability there may be perceptions of increased flooding or drought risk from the scheme, particularly if this is cumulative with longer term climate change forceasting which indicates slight decreases in rainfall and slight increases in the intensity of rainfall. No other river uses will be affected by the barrier impacts, reservoir operation or minor changes in Cisokan River flow.

Spatial boundaries vary based on the relevant habitat / ecosystem / environmental features of relevance to the VEC and the spatial extent of threats from the project other activities or environmental factors. They have been confirmed in Table 119 below.

The temporal boundary was set at 30 years, as this was a reasonably foreseeable time period within which the project will be operating and have impacts and is in step with the rate of degradation of habitat from existing development stressors (predicting that within 30 years, without intervention, the habitat and key species are likely to be absent from the project area).

Step 2: Scoping Phase 2 – Other Activities and Environmental Drivers.

The other activities and environmental drivers that are relevant for the CIA were assessed as part of the iterative process of identifying VECs and spatial boundaries. Relevant river-based activities include the existing Cihea weir and Saguling, Cirata and Jatiluhur dams within the Ciratum River system (downstream of UCPS), which have created barriers and destroyed river habitat over many decades and include the intensive urbanization of the mid and lower Ciratum River systems, both of which likely to be responsible for the lack of indigenous fish / aquatic species and lack of longitudinal / diadromous migratory species identified in the project area. Climate change modelling predicts small changes in rainfall distribution and intensity, which isn't likely to have a significant impact on in-river habitat or species survival.

Land-based activities that are relevant for the CIA are the decades of intensive forest conversion and degradation for agricultural purposes, exotic forestry and settlements which has affected the number and type of species that remain in the catchment. Furthermore, there are specific ongoing threats to species from poaching and hunting for meat, medicinal trade, live animal trade and extermination / pest control because of perceived threats to people or livestock. These are significant existing stressors on forest habitats and the species within them, as discussed in detail in Section 6.12 and the BMP.

Table 119 CIA Outcomes

VECs that may be affected by the development	VEC Threshold(s)	Spatial boundaries	Temporal boundary	Impacted by project	Impacted by activities and environmental drivers	CIA on thresholds and Project Mitigation measures
VEC mammal species based on IUCN classification of CR or EN: **Critically endangered pangolin** **Critically endangered Javan Slow Loris** **Endangered Javan or Grizzled leaf monkey** **Endangered Javan gibbon** **Javan leopard – previously considered critically endangered but currently not evaluated under the IUCN red list.** **VEC mammal species based on conservation status VU, NT:** **Javan lutung** **Long-tailed macaques** **Black giant squirrel** **Small-clawed otter**	Various thresholds for the size of habitat required for viable populations. As per the professional judgement in the BMP relating to the natural range of species and the population dynamics the estimated habitat size is 3,800ha of contiguous forest habitat for viable populations of these key species. (Source BMP)	As per the maps in the ESIA and BMP – modified forest habitat in the broader catchment (5000ha+). (source ESIA, BMP)	30+ years to take into account the construction and operation of the UCPS and transmission line.	Access road improving access for settlement and land development, poaching and hunting. Land clearance, inundation and barrier effects of reservoirs and dams. Resettlement of project-affected people within the catchment and critical habitat increases demand for land-based livelihoods and agricultural conversions. Influx of job-seekers and camp followers put additional demand on agricultural and forestry land and products. Barrier effects and collision/electrocution effects from transmission line. (source ESIA)	All species are in decline and are destined for local extinction from: Community-driven land clearances for agricultural and settlement purposes (increasing populations, poverty and lack of alternative livelihood options). Controlled and uncontrolled burning. Perhutani exotic forestry displacing natural forest. Poaching and hunting for meat/live animal trade/pest control/medicinal trade. (source ESIA,BMP)	Thresholds are already exceeded and will continue to decline without the project. ICM approach to enhancing habitat within the catchment and project area influence, as per the BMP and FPF, to meet the sustainable habitat threshold of at least 3,800ha of contiguous forest. Increasing habitat while improving livelihood opportunities. Working with the other activities/drivers such as community and Perhutani.

VECs that may be affected by the development	VEC Threshold(s)	Spatial boundaries	Temporal boundary	Impacted by project	Impacted by activities and environmental drivers	CIA on thresholds and Project Mitigation measures
Javan mouse deer **(Source ESIA, BMP)**						
VEC Avifauna species based on ICUN classification of EN or CR **Javan Hawk-eagle** **(source ESIA)**	Reportedly estimated at 325 breeding pairs. Threshold is no further mortality directly or indirectly related to the project. (source IUCN)	Java.	30+ years to take into account the construction and operation of the UCPS and transmission line.	Project impacts remain uncertain, since the presence of the birds in the project area of influence is still uncertain. Transmission lines may create collision and /or electrocution risk leading to injury or mortality. Removal of large trees may impact on breeding sites. (source ESIA, BMP, ESMP)	Ongoing deforestation on Java from agricultural development and settlement and volcanic eruptions. (source IUCN)	Further study work required to identify the presence of Javan Hawk-eagle in the project area and the potential impacts and mitigation measures. Actions are listed in the ESMP.
River Users (economic, social) **Cihea Irrigation Scheme servicing 5,854ha of predominantly rice fields** **(Source ESIA)**	Water available for irrigation as per historic and future demand. Hundreds of livelihoods depend on the certainty of supply of water. Depending on the time of year 1m^3/s – 7m^3/s is required in the river at the location of Cihea weir to satisfy their	15km downstream of lower dam, on Cisokan River, to the Saguling dam and reservoir. Below which river users are not relevant to the project due to the large influence the dam has on downstream users.	30+ years to take into account the construction and operation of the UCPS.	Project impacts are low, as the UCPS discharges almost all inflow downstream (retaining 0.02m^3/s to replace losses). Some reduction in irrigation water may occur during reservoir filling (>6.21m^3/s take, all other water released). Reputational risk that the UCPS will be responsible for droughts and floods. (source ESIA).	Climate change predicted to bring small reduction in rainfall and small potential increase in intensity of rainfall events. Irrigation water demand may change with changing land use (increase or decrease in rice fields). Land use trends and district	e-flow regime addresses Cihea Irrigation Scheme requirements to maintain river flow thresholds. UCPS and Cihea Irrigation Scheme to agree on an MOU for supplying sufficient water downstream during reservoir filling.

VECs that may be affected by the development	VEC Threshold(s)	Spatial boundaries	Temporal boundary	Impacted by project	Impacted by activities and environmental drivers	CIA on thresholds and Project Mitigation measures
	irrigation needs and e-flow. (source ESIA)				planning indicate increases in the total area and output of rice leading to increased water demand by the scheme. In the longer term (20y+) this may be reduced by increased water use efficiency and conversion of rice fields to other crops or settlement. (source ESIA, CIA screening).	Improved water flow measurements to more accurately record and manage inflow and outflow of UCPS to ensure Cihea Irrigation Scheme water is available. This will address changes to water demand over time within the 30yr temporal boundary. (ESIA, ESMP).

CHAPTER 13. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

13.1 General

The Environmental and Social Management Plan (ESMP) is the main mechanism for managing and mitigating during the construction, inundation, and operations of the Upper Cisokan Pumped Storage (UCPS) Hydropower Plant (PLTA) with a capacity of 1040 MW and a 500 kV Transmission Line, and supporting infrastructure such s access roads. The purpose of the ESMP is to guide implementation of mitigation measures and monitoring requirements identified through the EIA process in 2011 and the updated ESIA in 2020 which complies with the World Bank Environmental and Social Standards (ESS1 – ESS10) of the Environmental and Social Framework. Both the ESIA and the ESMP were updated in 2020 by PLN in collaboration with UNPAD.

This chapter discusses management or mitigation efforts that can be carried out to minimize and prevent impacts that have been identified in the ESIA document in Chapter 10 (Construction Stage), Chapter 11 (Impoundment Stage) and Chapter 12 (Operational Stage).

Mitigation strategies suggested in this section are detailed in the ESMP document (Environmental and Social Management Plan). There are a number of sub-plans to deliver specific environmental and social management activities. The ESMP document will, at minimum, include details regarding the following:

- Roles and responsibilities of parties involved in the project.
- Important environmental and social risks
- Mitigation, management and monitoring of all key risks during the activity phase of the Upper Cisokan hydropower plant.
- Report responsibilities and methods
- ESMP updating process

The ESMP is a living document that details the appropriate environmental and social impact mitigation and monitoring measures required during the construction, inundation, and operational phases of the UCPS Hydropower Plant. Preparation of this ESMP is guided by the results of evaluation of the potential environmental and social impacts presented in the ESIA document. The ESMP document will be used as a key reference in the preparation of the Contractor ESMP (C-ESMP) document which will contain the necessary environmental and social management actions during construction in accordance with the details of the construction plan carried out by the contractors for each package. A number of topic specific environmental and social management are included as sub-plans of the ESMP. These sub-plans are the SCMP *(Social Community Management Plan, which includes the SEP, LMP, GRM, GAP, and GBVAP)* which guides the management of social and community issues during construction and operation of the UCPS; the BMP *(Biodiversity Management Plan)* which guides the management of biodiversity during construction and operation of the UCPS. The LARAP *(Land Acquisition and Resettlement Action Plan)* documents the requirements with regards to the project-affected community.

13.2 Purpose and Objectives

This ESMP is a living document that is adapted, updated and improved as the project progresses. The broad aims of the ESMP are:

- Ensuring compliance with national regulatory authority stipulations and guidelines, as well as ensuring compliance with the World Bank Environmental and Social Framework.

- Ensuring that there is sufficient allocation of resources in the project budget so that the scale of ESMP-related activities is consistent with the significance of project impacts.

- Realising the agreed environmental and social objectives for the Project and verifying environmental and social performance through information on impacts as they occur.

- Responding to changes in Project implementation not considered in the impact assessment process thus far or responding to unforeseen events.

To achieve these objectives, the ESMP contains the following information:

- Definition of the environmental and social commitments and mitigation strategy identified in the ESIA for construction, inundation and operation phases, and any supplementary E&S studies which will be implemented over the lifetime of the Project;

- Description of the management actions necessary to implement the commitments and mitigation strategy, including the manner in which they will be executed, the schedule, the resources and performance indicators.

- Description of the means of monitoring and assessing the performance of the social and environmental actions, so that they can be adapted and/or improved, plus the corresponding documentation.

- Definition of responsibilities: organisational structures, roles, communications and reporting process required for the implementation of the ESMP.

The implementation of this ESMP will ensure that PLN, contractors, consultants, and their subsidiaries carry out the construction and operation of the Scheme with due regard for environmental and social protection and provision.

It will be the responsibility of PLN to ensure the following requirements are met:

- Enforce and comply with all relevant environmental and social laws (see Chapter 4).

- Fulfill all commitments of the PLN 1040 MW PLTA Upper Cisokan Pumped Storage Environmental and Social Impact Assessment 2020.

- Fulfill all ANDAL, RKL and RPL commitments in accordance with Indonesian Regulations.

- Protect the environment and communities around the project.

- Enforce environmental and social compliance, awareness and understanding among employees, contractors, subsidiaries, and consultants, through:
    - Training and Inductions.
    - The assignment of roles and responsibilities under this ESMP.
    - The relationship between environmentally and socially responsible performance and overall performance.
    - Foster a shared sense of responsibility for environmental and social performance among all project participants.
    - Monitor environmental and social performance and implement continuous corrective actions as necessary.
    - Ongoing interaction with various stakeholders involved in the project.
- Communicate regularly with stakeholders, including government agencies and regulatory agencies, host communities and interest groups, to report on environmental and social performance, regulatory compliance, and project progress, and to understand and address stakeholder concerns.

The implementation of the ESMP by PLN and the associated reporting and communication will provide a mechanism by which government agencies, communities and other stakeholders can be informed about the project's environmental and social impact management and enable participation in these processes. The ESMP provides clarity and transparency around PLN's plans, responsibilities, legal obligations and targets.

13.3 ESMP Organization and Structure

The ESMP is designed as the main document in the control plan hierarchy during the project phase (Construction, Inundation, and Operations). The ESMP establishes the environmental and social management framework that will be applied to the project. The plan covers Environmental and Social Management Principles, Communication, Reporting, Monitoring and Review Procedures that all parties must comply with, including the relevant sub-plans.

The UCPS Hydropower ESMP framework for the Project Phase during the Construction, Inundation, and Operations stages comprises the following sub-plans:

Table 120 Summary of ESMP Sub-plans

Plan	Purpose	Responsibility	Timing
Contractors' Environmental and Social Management Plans (CESMP)	Detailed processes and procedures for management of environmental, social, security, health and safety impacts during construction.	PLN will approve and supervise the CESMP. Each Contractor for each Package will prepare and implement their CESMP.	Cleared prior to contractor mobilization
Social and Community Management Plan	Aligns with ESF requirements, in particular ESS 2, ESS 4, and ESS 10.	PLN will implement the SCMP	Prepared prior to project appraisal.

Plan	Purpose	Responsibility	Timing
	Processes and procedures to manage social and community issues. Aspect specific plans under the SCMP are: Labor Management Plan and Grievance Redress Mechanism for workers. Gender Action Plan. Gender Based Violence, Action Plan (Sexual Exploitation and Abuse/ Sexual Harassment (SEA/AH)) and Violence against children (VAC). Stakeholder Engagement Grievance Redress Mechanism for communities. Influx management.	The Contractor will implement via their CESMP	
Biodiversity Management Plan	Meet the ESS6 requirements of net gain of critical habitat. Manage construction-related impacts, direct impacts from infrastructure footprint and indirect impacts from induced development.	PLN will implement the BMP The Contractor will implement via their CESMP	Prepared prior to project appraisal/ BMP and Critical Habitat Assessment for Transmission Line to be prepared.
Reservoir Preparation Plan	Aligns with ESS4, to avoid damage and impacts on households and the wider community, and ESS6 to minimize environmental and biodiversity impacts, and achieve no net loss / net gain, during preparation of the reservoirs and inundation.	PLN will prepare the RPP, for implementation by the selected contractor.	Prepared within two years of the project effective date to allow all activities to be done prior to inundation.
Cultural Heritage Management Plan	Aligns with ESS8, to avoid and protect cultural heritage sites, and respectfully move graves and cultural sites prior to inundation.	PLN will implement. The Contractor will implement via their CESMP	Prepared prior to appraisal.
Transmission Line Environmental and Social Management Plan	Detailed processes and procedures for design and for management of environmental, social, security, health and safety impacts during construction. construction and operation of the TL.	PLN will prepare and implement the TL ESMP. The selected contractor will implement via their CESMP.	To be completed for bid documents for design and construction of the TL.
Quarry Management Plan	Details the preparation, operation and restoration of the Gunung Karang quarry The plan details the measures required to prevent and reduce environmental and social impacts during the operation of the quarry.	Main Contractor, Lot 1a and Lot 1b. The selected contractor will prepare and implement via their CESMP. PLN will review and approve, with the support of the Supervision Engineer.	Prior to mobilization to site.
Operational Environmental and Social Management Plan	Detailed processes and procedures for flow management, management of downstream impacts, biodiversity management, reservoir management, dam	PLN will prepare and implement	At least six months prior to inundation.

Plan	Purpose	Responsibility	Timing
	safety, and stakeholder engagement		

Any reference to 'ESMP' in this document means all procedures in this document and their corresponding sub-plans.

13.4 ESMP Roles and Responsibilities

PLN, the Supervision Engineer (ESSHS), Contractors and the Independent Review Panel will all have the responsibility to supervise, implement, review and/or revise the various sub-plans, as shown in Table 121.

Table 121 List of Plan, Tasks, Sub-Plans and the Roles and Responsibilities for Supervision, Review, Revision and Implementation

Plan	Key tasks or sub-plans	PLN Project Management Team (Environmental Unit)	Supervision Engineer (ESSHS)	Contractors	Independent Review Panel
UCPS Environmental and Social Management Plan		Preparation and Implementation	Supporting		Review and expert advice
	Capacity Training	Preparation and Implementation	Supporting		Review and expert advice
	Plan Monitoring and Review	Preparation and Implementation	Supporting		Review and expert advice
	Communication / Reporting to external agencies	Preparation and Implemnetion	Supporting		Review and expert advice
	Environmental and Social Monitoring	Preparation and Implementation	Supporting		Review and expert advice
Contractors Environmental and Social Management Plan		Approve Supervision	Technical Review & Support PLN to Approve, and Supervise Contractor	Preparation Implementation	Review of preparation and implementatio n
Reservoir Preparation Plan		Preparation Supervision	Supervise Contractor	Implementation (via CESMP)	Review and expert advice
Social and Community Management Plan		Implementation	Supervision of Contractor	Implementation (via CESMP)	Review and expert advice
Cultural Heritage Management Plan		Implementation	Supervision of Contractor	Implementation (via the CESMP)	Review and expert advice
Biodiversity Management Plan		Implementation	Supervision of Contractor	Implementation (via the CESMP)	Review and expert advice
Transmission Line Environmental and Social Management Plan		Preparation Implementation	Supervision of Contractor	Implementation (via the CESMP)	Review and expert advice
Quarry Environmental Management Plan		Approve Supervision	Technical Review & Support PLN to Approve Supervision of Contractor	Preparation Implementation (CESMP)	Review and expert advice
Operational Environmental and Social Management Plan		Preparation			Review and expert advice

Plan	Key tasks or sub-plans	PLN Project Management Team (Environmental Unit)	Supervision Engineer (ESSHS)	Contractors	Independent Review Panel
		Implementation			

13.5 Impact Mitigation Framework (Environmental and Social Management Plan)

Mitigation efforts are based on the results of an assessment (evaluation) of the impact of each parameter in environmental and social aspects. Impact significance results determine whether an impact needs to be mitigated or not (Table 122). Mitigation is carried out for parameters that have moderate, major, and critical significance impact.

Table 122. Overview of Impact Significance and related mitigation needs

Impact Type	Impact Significance	Mitigation	Table reference
Construction Stage			
Soil Loss and Productivity Impact Assessment	Moderate	Should be mitigated where practicable	Table 47
Erosion and Sedimentation of Cisokan and Cilenkong Rivers	Moderate	Should be mitigated where practicable	Table 48
Erosion and Sedimentation of Cirumamis River	Moderate	Should be mitigated where practicable	Table 49
Sedimentation in Cijambu River	Minor	No action required	Table 50
River Habitat and Water Quality of Cisokan River	Minor-Moderate	Mitigation recommended	Table 51
River Habitat and Water Quality of Cirumamis River	Minor-Moderate	Mitigation recommended	Table 52
River Habitat and Water Quality of Cirendeu River	Minor-Moderate	Mitigation recommended	Table 53
Air Quality on Gunung Karang Quarry	Major	Must be mitigated to reduce impact to Acceptable Level	Table 54
Air Quality on Access Road	Minor-Moderate	Mitigation recommended	Table 56
Air Quality at Main Construction Sites	Minor-Moderate	Mitigation recommended	Table 57

Impact Type	Impact Significance	Mitigation	Table reference
Noise on Gunung Karang Quarry	Major	Must be mitigated to reduce impact to Acceptable Level	Table 58
Noise on Access Road	Moderate	Should be mitigated where practicable	Table 60
Noise at Main Construction Sites	Moderate	Should be mitigated where practicable	Table 61
Noise on the Transmission Line	Negligible	No action required	Table 62
Vibration at Gunung Karang Quarry	Major	Must be mitigated to reduce impact to Acceptable Level	Table 64
Vibration along the Access Road	Negligible-Minor	No action required	Table 66
Vibration at Major Construction Sites	Minor-Moderate	Mitigation recommended	Table 69
Gunung Karang Quarry Water Resource	Major	Must be mitigated to reduce impact to Acceptable Level	Table 70
Population Decline and Threats to Protected Wildlife at UCPS	Major	Must be mitigated to reduce impact to Acceptable Level	Table 73
Land Acquisition and Resettlement	Moderate	Should be mitigated where practicable	Table 74
Impact on Livelihood Changes	Major (Neutral)	No action required	Table 75
Impact on Women Land Owners Livelihoods	Major (Positive)	No action required	Table 76
Impact on Demographic Changes	Negligible (Neutral)	No action required	Table 77
Impact on Income Related to Construction Activities	Minor-Moderate (Positive)	No action required	Table 78
Impact of Workers from Outside UCPS to Social Activities	Major	Must be mitigated to reduce impact to Acceptable Level	Table 79
Impact on Intangible Cultural Heritage	Major	Must be mitigated to reduce impact to Acceptable Level	Table 80

Impact Type	Impact Significance	Mitigation	Table reference
Public Social Disturbance around the Project	Minor-Moderate	Mitigation recommended	Table 81
Impact on Traffic Safety	Minor-Moderate	Mitigation recommended	Table 82
Impact on Employment and Business Opportunities	Major (Positive)	No action required	Table 83
Impact on Community Lifestyle, Health and Culture	Moderate	Should be mitigated where practicable	Table 84
Impact of High-Risk Construction Activities	Critical	Must identify alternative to reduce impact to Acceptable Level	Table 85
Impoundment Stage			
Cisokan and Cirumamis River Flow	Minor-Moderate	Mitigation recommended	Table 89
Habitat Change and Biodiversity in the Cisokan and Cirumamis Rivers	Moderate	Should be mitigated where practicable	Table 90
Draw-Down Erosion-Sedimentation Impact of the Upper and Lower Dams	Minor	No action required	Table 91
Reduced Vegetation and Loss of Habitat	Major	Must be mitigated to reduce impact to Acceptable Level	Table 93
Impact on Habitat Fragmentation and Barrier	Major	Must be mitigated to reduce impact to Acceptable Level	Table 94
Population Decline and Threats to Protected Wildlife	Major	Must be mitigated to reduce impact to Acceptable Level	Table 95
Interference on the movement of birds on the Transmission Line	Major	Must be mitigated to reduce impact to Acceptable Level	Table 96
Impact on Downstream User	Moderate	Should be mitigated where practicable	Table 97
Impact on Community Connectivity (Bridge Access)	Major	Must be mitigated to reduce impact to Acceptable Level	Table 98
Operational Stage			
Erosion and Sedimentation Changes in the Cisokan River	Minor-Moderate	Mitigation recommended	Table 101

Impact Type	Impact Significance	Mitigation	Table reference
Cisokan River Flow	Minor	No action required	Table 103
River Habitat Quality	Minor-Moderate (Neutral)	No action required	Table 104
Cisokan River Water Quality	Minor-Moderate	Mitigation recommended	Table 105
Land Use Impact from the 500 kV UCPS Transmission Line	Negligible	No action required	Table 107
Visual Impact from the 500 kV UCPS Transmission Line	Negligible	No action required	Table 108
Deforestation and Forest Degradation through Agricultural Conversion	Major	Must be mitigated to reduce impact to Acceptable Level	Table 109
Impact on Wild Animal Hunting and Catching	Minor-Moderate	Mitigation recommended	Table 110
Impact on Increased Access and Development	Minor	No action required	Table 111
Occurrence of Electric Shock and Collision Risks to the Wild Animals on the Transmission Line	Major	Must be mitigated to reduce impact to Acceptable Level	Table 112
Impact of revegetation on buffer areas	Major (Positive)	No action required	Table 113
Development Along the Access Road by Immigrants	Negligible (Positive)	No action required	Table 115
Health Impact along Transmission Line	Negligible	No action required	Table 116
Impact of High-Risk Operational Activities	Major	Must be mitigated to reduce impact to Acceptable Level	Table 118

13.6 Environmental and Social Management Mitigation Construction Stage

13.6.1 River Habitat and Water Quality

Decreasing water quality and changing river habitats in the Cirumamis, Cirendeu and Cisokan rivers; especially with regard to increased levels of pollutants from domestic waste and suspended solids by domestic waste and erosion of land clearing.

Mitigation:

- Reducing the discharge of sediment-laden water into water bodies directly without treatment at the quarry, upper dam construction sites and lower dam construction sites.
- Reducing the disposal of domestic waste from worker activities into the Cisokan, Cirumamis, and Cireundeu rivers.
- Activities of clearing land are carried out systematically by observing the working principles in accordance with the established SOP.
- Socialization of the domestic waste management program to the community by piloting domestic waste management, especially building communal or private toilet facilities.

13.6.2 Erosion and Sedimentation

Increase in the amount and rate of erosion has an impact on decreasing water quality and river habitat quality in the Cisokan River, Cilengkong and Cirumamis River..

Mitigation:

- Management of controls to keep soil erosion to a minimum.
- Diverting the river flow from the work area within the river, and minimizing the amount of work in the river channel.
- Reducing intentional dumping of material into waterways.
- Promptly restoring work-affected areas with suitable vegetation planting.
- If possible, maintaining riparian vegetation as a holding zone to help capture sediment before it enters the water body.

13.6.3 Air Quality

Decline in air quality will affect sensitive receptors such people and wildlife. Air quality may be affected in the form of dust, particulate matter and gas emissions from exhausts. Dust mainly comes from the use of roads, cleared land and riverbeds in the work area and during reservoir cleaning, material stockpiling, quarry operations, stone grinding, blasting in quarries and work sites, and cement manufacturing sites. Particulates (other than dust) and gas are emitted from vehicles, heavy machinery, diesel generators and asphalt processing sites.

Impacts on respiratory health of surrounding communities. Impact will be less on workers who will wear PPE.

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Mitigation:

- Setting a schedule for mining activities, vehicle mobilization, and land clearing activities.
- Using tools, machines, and vehicles that meet emissions standards.
- Firmly securing loads on transport trucks to avoid spilled material along the road.
- Performing regular watering on roads that will be traversed by material transportation from the quarry to the activity location, especially roads near residential areas.
- Concrete collection plants and equipment that contributes to particulate pollution, should be located as far away from the settlements as possible.

13.6.4 Noise

Increased noise from 1) Gunung Karangmining, crushing and use of heavy vehicles at the Gunung Karang quarry site, 2) the main road from the quarry to the main construction site, 3) construction activities of the upper weir, lower weirs and other supporting facilities, and 4) mobilization activities tools and materials in the construction of the 500 kV transmission line tower.

Mitigation:

- Using a dampening barrier in the quarry environment of Gunung Karang
- Socialize activities to the community
- Turn off vehicles and equipment when not in use
- Set a schedule of use of vehicles and heavy equipment to limit numbers at any given time.
- Set the time for activities at locations close to the receptors, such as settlements, access roads, and public infrastructure.

13.6.5 Vibration

Increased noise from 1) mining, crushing and use of heavy vehicles at the Gunung Karang quarry site, 2) the main road from the quarry to the main construction site, 3) construction activities of the upper weir, lower weirs and other supporting facilities, and 4) mobilization activities tools and materials in the construction of the 500 kV transmission line tower

Mitigation:

- Carry out blasting activities at the Gunung Karang quarry, tunnel portals and lower dam location in accordance with the established standard operational procedures..
- Carry out the socialization of the affected communities.
- Set the operating time of all machines and vehicles that generate vibrations.
- Use of a list of complaints and procedures for dealing with problems as they arise.

13.6.6 Biodiversity Impacts from the Reservoirs and Access Road

A Biodiversity Management Plan (BMP) has been prepared to manage the direct and indirect impacts of the Cisokan hydropower project on the condition of biodiversity and for the maintenance of project-affected areas. This BMP updates and supersedes the previous BMP publicly disclosed in 2011 as a sub-plan to the ESMP, as well as the BMP prepared but not published in 2015.

Integrated Catchment Management through a Forest Partnership Framework aims to offset impacts by reforesting a connected (agro-)forest landscape across 3,800 ha of land around the UCPS reservoirs and project facilities. The 3,800 ha of restoration aims to provide a net positive gain, offsetting the 500 ha of direct impacts and the 2,629 ha of indirect impacts, or 1,867 ha under the counterfactual scenario. The net positive gain targeted from the biodiversity offset against the counterfactual scenario is estimated at 3,800 ha – 500 ha (direct impacts) – 2,629 ha (indirect impacts) + 762 ha (counterfactual loss) = 1,433 ha over a 30-year time frame. It simultaneously aims to restore the terrestrial biodiversity component by significantly increasing ecological connectivity among forest areas, benefiting species that trigger the Critical Habitat criteria, such as Slow Loris and Grizzled Leaf Monkey, and the aquatic habitat by improving ecological conditions alongside tributaries flowing into the reservoirs and through improved fish management. The restoration and offsetting strategies aim to fulfil socio-economic objectives through the development of financially viable social forestry and agroforestry programs. These aim to restore original agroforestry-based land uses in the UCPS area that provide communities with improved income and reduce ecologically damaging land practices, such as open field agricultural on steep slopes.

The BMP provides practical guidance for reducing threats to biodiversity where practical, to manage identified risks, to engage with communities and stakeholders, and to pro-actively support the development of knowledge in biodiversity conservation using the ESS 6 mitigation hierarchy. Through this BMP, the aim is to engage with biodiversity professionals, government, the community, non-government organizations (NGOs), researchers and appropriate individuals to achieve a high standard of biodiversity and conservation management.

The Biodiversity Management Plan is implemented through an Integrated Catchment Management (ICM) approach that simultaneously addresses biodiversity, environmental and social aspects of landscape management. It provides a sound rationale for a range of actions that focus on:

- Construction-related impact mitigation and management;
- Reforestation and forest management;
- Wildlife management;
- Stakeholder participation; and
- Community engagement.

Within the project area of influence the BMP goals are:

- To achieve net gain of Critical Habitat and Natural Habitat.
- To protect and enhance the remnant forest communities (both the habitat and wildlife) to create a self-sustaining ecosystem.
- To protect and increase the populations of critically endangered and endangered species so that they are self-sustaining.

- To take into account the ongoing threats to biodiversity conservation from the community and rural development in the selection and implementation of conservation strategies.
- To create a common understanding amongst stakeholders and the community about the biodiversity values and threats.

This plan provides clear guidance on how to protect and restore habitats and to protect and manage endangered species in the project area of influence. The approach is based on adaptive management, requiring continuous monitoring of success. Depending on the on-going achievements or setbacks in the field, the plan is flexible and allows changes to the basic approach.

The ICM approach aims to deliver sustainable land and resource use outcomes for Upper Cisokan area, and with that develop a "Green Dam". The ICM Plan will be developed and implemented in parallel with the site-based conservation programs that focus more on the areas directly impacted by project development. The challenges to maintain Cisokan's highly threatened wildlife are large. A well-funded and executed, politically supported ICM approach is key to the long-term survival of these species.

Detailed mitigation measures are presented in the BMP Action Plan 2020 document, demonstrating that there are several mitigation strategies that need to be carried out at the construction stage, including:

1. Reducing Fragmentation and Loss of Habitat

- Prior to construction starting in any area, survey and clearly mark the BIAs (Working Zone 1) and any areas in Working Zone 2 or 3 confirmed for reforestation by the PLN/Perhutani PKS with tags/markers at least 1 month before.
- Agreement for BIA (and blocks in Working Zone 2 and 3) management in accordance with the BMP is required from Perhutani under the MOU and PKS agreement process. Shapefiles of the boundaries of BIAs need to be uploaded onto Geographic Positioning Systems (GPS) and used in the field to work out exactly where these boundaries are and where the physical markers that demarcate the boundary should be placed.
- Actions 1 and 2 are to be repeated for any new areas in Working Zone 2 and 3 confirmed for reforestation by the PLN/ Perhutani PKS during the period of Construction, where the land is at risk from impact from construction activities and / or encroachment.
- Implement the land clearing SOP during any necessary works with in the BIA.
- Provide features such as tunnels or rope bridges along temporary roads to enable wildlife movement and to reduce potential traffic incidents.

Slope stabilization and revegetation will be implemented in areas disturbed for project construction. Specific guidance on this is provided in the SOP for Land Clearing and Rehabilitation, including methods for establishing and maintaining tree nurseries (Appendix 7 of the BMP):

1. Along the road between km 13 to km 22, especially in degraded road side areas, perennials plants should planted, from the "support zone type".

2. In areas close to settlements, reforestation of the road cuttings will be done with plants that are beneficial to the community (non-timber benefits). These could include plants from the “support zone type” or “agroforestry type”. Final plant species selection depends on preferences from the communities for particular species, the extent to which these species would be used by local wildlife (and thus provide a possible of human-wildlife conflict), and their value for wildlife.
3. Along steep areas adjacent to the road between km 22 and km 25 native shrubs and trees should be planted. In addition to functioning for habitat enrichment, planting the shrubs and trees also aims to stabilize slopes and provide wildlife habitat. Prior to planting, terracing should be considered, also in reference to slope stabilization.
4. In soil disposal areas, dam sides and around main buildings, revegetation is required to stabilize soils. Consultation with communities and other stakeholders should determine what type of plants should be used for revegetation. This component will be further developed by PLN, once locally optimal and jointly agreed trade-off solutions have been developed between the social, economic and environmental objectives of the area’s management.
5. Manage the UPK nursery to supply the type of plants and the volume of plants needed for road and construction site landscaping, as recommended in the planting list. Plants need to be supplied in a timely manner to avoid excessive time periods of soil exposure. Plant seeds, seedlings and saplings need to be collected during land clearing, and maintained in tree nursery areas before being used to restore the area. Plants can be sourced from other nurseries as required.
6. Contractor’s landscape plan to be consistent with the BMP.

2. Access Control

- Create guard post on access and inspections roads near residential areas such as Cipateungteung and Datarmala, and near protected forest areas such as Gowek forest and the Japarana and Walet waterfalls.
- Perform routine surveillance inspections on roads and in BIAs with the cooperation of local landowners in order to remove traps and deter hunting, logging and removal of plants. These activities should initially focus on the area directly impacted by development, where PLN has legal ownership.
- Install and maintain signs banning the use of roads by unauthorized people.
- Install and maintain signs banning hunting, snaring, and other activities that could harm protected wildlife, particularly near BIA and Working Zones.

3. Fire Management

- Project workers are prohibited from making fires for cooking, burning trash, or campfire except within the base camp or other locations specified by the Contractors’ Environmental Manager or PLN. Prohibit careless disposal of cigarette butts.
- A firefighter team is formed by the Contractors to fight fires when these do occur.
- Fire risk factors within the vicinity of the site need to be identified and monitored, e.g. proximity to active slash-and-burn clearing for cultivation by local communities.

- Fire breaks shall be established around areas of potential high fire risk, e.g. the camp and offices.
- Education and awareness raising of local communities with regard to fire management and prevention, and collaborative approaches to multi-objective management of areas that targets both increased community incomes and more permanent tree cover (and reduced fire use) on the area's slopes. (Community engagement to occur in an integrated way with other UCPS programs (such as social mapping, project consultation etc.).

4. Management of Traffic Impacts on Wildlife

- Information campaigns to explain to drivers about the biodiversity management objectives that seek to avoid wildlife collisions and disturbance, including:
- Explanations of the kind of animals likely to be encountered on roads (snakes, nocturnal wildlife etc.), and the appropriate action to be taken to avoid road kills.
- The importance of adhering to local vehicle speed limits, and the consequences of not doing so.
- The need to report when animals have been hit, and clarity about where these reports are kept and who they need to be reported to.
- Install and maintain signs in areas of frequent wildlife crossings, saying "beware of animal crossing" (complete with pictures of animals).
- Develop a system in which drivers report locations of wildlife crossing and wildlife sightings.
-

6. Stakeholder participation and community engagement

- Revise current MOU with Perhutani and develop new agreement that targets landscape level reforestation
- Engage an ICM Facilitation Team
- Develop and implement effective stakeholder engagement, especially with communities whose livelihoods will change with increasing forest cover in the area.
- Work with the resettlement team, PEMDA and village communities in a participatory way to find solutions to resettlement that avoid conflicts with the BMP and to enhance any opportunities to improve land use, land cover etc. in a way that meets the goals and actions of the BMP.
- Facilitate the opportunities for income from the reforestation process: plant material collection, tree nursery management and / or tree planting contracts.
- Work with communities to identify keen groups or individuals to work with Perhutani on forest patrolling activities.

13.6.7 Access to water Sources in Quarry Gunung Karang

The loss of drinking water or other domestic water supply sources in the Gunung Karang quarry is possible due to andesite mining activities.

Mitigation:

Provision of clean water through drilling wells or other communal water supply models (*embung*) for the communities around the Gunung Karang quarry.

13.6.8 Process and Impact of Resettlement

The impact of the resettlement process and supporting facilities at Kp. Cangkuang, Bojongsalam Village, Jolok Block, Cicadas Village, Kp. Pasirlaja Sukaresmi Village, Santik Block, Bojongsalam Village and Pasirjegud Kp. Tapos Sukaresmi Village.

The LARAP Implementation Review (2021), found that 66% of the households, that had relocated, already owned their residential land. The results of the pre-and post-resettlement condition assessment survey show that households have increased the area of residential land and building area. This indicates better living conditions, especially for respondents affected by inundation who have moved. Most PAPs have larger buildings than before resettlement. The PAPs have also benefited from the construction of new roads, and livelihood restoration/economic recovery program have improved both quality of life and facilitated opportunities for growth.

Mitigation:

Monitoring and evaluating whether the construction process at the resettlement site is in accordance with the plan. The project will look to improve LARAP management, finalize PAP relocation and rehabilitation, improve stakeholder engagement (especially for women), establish the GRM, and complete its commitments towards improving community infrastructure. Further details are provided in the LARAP IR.

13.6.9 Livelihood Change

There was a slight shift in the livelihood for a number of residents during construction activities.

Mitigation:

1. Involving local workers in project implementation, especially for affected communities.
2. Use of cooperatives and monitoring to ensure that projects run smoothly.

13.6.10 Risk of Labor from Outside the Project Area (Labor Influx)

Workers from outside the project area, such as contract workers, will come to the project area which may impact on the community, especially in community social activities during the construction process. Table 123 summarizes the key labor risk and mitigation measures covered in the LMP. Further details on gender impacts from labor influx and mitigation measures can be found in the GAP and GBVAP in the SCMP.

Mitigation:

1. Control over worker behavior
2. Implement camp management for workers

3. Develop a workforce recruitment system starting from the number of labor requirements, the required criteria, the transparency of the admissions pathway and the form of employee acceptance tests.

Table 123. Key Labor Risk Assessment and Mitigation Measures

Risks	Mitigation measures
OHS risk is high due to physical hazards associated with demolition, reconstruction and construction and low awareness/experience/capacity amongst employers/workers to identify and manage risks.	OHS training, provisions of Protective Personal Equipment (PPE) and oversight as further defined in the LMP
Child labor/risk of underage labor (under 15) is considered low. Participation of youth labor (15-17 years) is likely and there is a risk that they may be involved in in hazardous work or experience interruption of education.	Codes of Conduct and age requirements for workforce to be incorporated in bidding documents and worker contracts, labor supervision as further defined in the LMP
Use of third-party contractors, primary suppliers may present OHS risks. Nevertheless, the project's leverage to enforce corrective actions on these types of workers may be limited.	Inclusion of primary supplier requirements in bidding documents and contracts, labor supervision as further defined in the LMP
A small/light security team will be stationed at the site to guard the area.	The security team will be trained on Codes of Conduct, including GBV issues.
The influx of workers and service providers into communities may increase the rate of crimes and/or a perception of insecurity by the local community. Such illicit behavior or crimes can include theft, physical assaults, substance abuse, prostitution and human trafficking. Local law enforcement may not be sufficiently equipped to deal with the temporary increase in local population.	Construction workforce management as defined in the CESMP, including provisions of health, recreational facilities, and other basic services, labor supervision and contracting requirements (i.e. Codes of Conduct, GBV)
The presence of construction workers and service providers (and in some cases family members of either or both) can generate additional demand for the provision of public services, such as water, electricity, and medical services. This is particularly the case when the influx of workers is not accommodated by additional or separate supply systems.	As above
The influx of people may bring communicable diseases to the project area, including sexually transmitted diseases (STDs). Incoming workers may be exposed to diseases to which they have low resistance, particularly in the post-disaster context. This can result in an additional burden on local health resources. Workers with health concerns relating to substance abuse, mental health issues, or STDs may not wish to visit the project's medical facility, and instead go anonymously to local medical providers; thereby placing further stress on local resources. Local health and rescue facilities may also be overwhelmed and/or ill-equipped to address the industrial accidents that may occur.	OHS and communicable health awareness training, labor supervision, provisions of recreational activities and work-life balance arrangements Further details on gender impacts and mitigation measures can be found in the GAP and GBVAP in the SCMP.

Separation from families especially among construction workers who are away from home for construction jobs may encourage undesired behaviors, such as exploitative sexual relations, and illicit sexual relations with minors from the local community.	As above and codes of conduct in work contracts, GBV/SEA awareness to both workers and local communities
Delivery of supplies for construction workers and the transportation of workers can lead to an increase in traffic and a rise in accidents.	Traffic management as further defined in the ESMP
Labor influx may lead to temporary local price hikes and/or crowding out of community consumers.	On-going monitoring as part of the E&S monitoring plan.

13.6.11 Cultural Heritage

There are cultural relics such as private graves and religious buildings within the project area which should also be respected and protected during reservoir construction and preparation.

Mitigation:

1. Implement Cultural Heritage Management Plan and procedures.
2. Conduct consultations with the community regarding cultural objects around the project
3. Monitoring of cultural objects during construction activities to minimize damage or loss of cultural objects. For example, building fences around cultural objects.
4. Intangible cultural heritage requires the preparation of a conservation plan for customary values

13.6.12 Social Disturbance from Communities around the Project

Cisokan Hydropower development activities generated a public perception related to the impact. The predominant problems or negative perceptions expressed by residents included the process of land acquisition, labor recruitment, compensation for community comfort, health, explosion disturbances, cracks in houses, absence of electricity, unsuitable SPPT value and unpaid remaining land.

Mitigation:

1. Periodic socialization of the activities to be carried out by PLN in community areas.
2. Tabulate PLN activities along with time, target completion, and person in charge so that the information is easily accessed and interpreted by the community.

13.6.13 Traffic Safety

The traffic during the construction process will be very high, especially due to the mobilization of heavy vehicles from the quarry to the main construction site.

Mitigation:

To anticipate the impact on traffic safety mitigation measures were integrated into the design of the road upgrades such as road signs in key areas such as schools, villages and intersections; and pathways for pedestrians, such as sidewalks and zebra crossings. In addition, there are several things that still need to be developed into the structure and safety design of access road users, which include:

1. Warning signs for all connecting roads, to warn traffic users that there are heavy vehicles on the access road.
2. Provide noise suppression in schools and mosques.
3. Ensure adequate road turns for heavy vehicles, and increase visibility at turns and intersections by installing mirrors.

Traffic management will be a major part of the Construction Environmental and Social Management Plan. Heavy vehicle traffic cannot be reduced, but still managed. Management options include:

1. Limit construction vehicle traffic during the hours that children travel to and from school, and provide traffic management to direct traffic during these hours.
2. Very large / heavy vehicles require an escort vehicle.
3. Adding safety signs for access roads at fixed intervals.
4. Outreach programs for students and the community.
5. Informing the public about regular traffic movements.
6. Driver outreach program.
7. Recording of complaints and plans for their implementation.

Consideration of road design, heavy traffic restrictions and management, and extension programs, which will contribute to safer roads, minimizing potential risks to road users.

13.6.14Occupational Health and Safety

Significant harm is anticipated based on the risky nature of the workplace and tasks.

Mitigation:

1. Focus on identifying and managing risks for every task.
2. Ensuring Contractors prepare comprehensive risk assessments, risk registers and use the risk management hierarchy in their approach.
3. Ensure adequate training, supervision, record keeping, evaluation and review of health and safety management and incidents.

The detailed environmental and social management and monitoring plans during construction will be documented in the C-ESMP document.

13.7 Environmental and Social Management Mitigation Inundation Stage

13.7.1 Changes in River Flow Habitat and Biodiversity

Changes in river flow habitat and biodiversity due to damming of river flow.

Mitigation:

- The e-flow regime as detailed in Section 12.2.1 to be implemented, which will allow for natural flow fluctuations downstream in the Cisokan River and maintenance of natural downstream flow in the Cirumamis River.
- Inundation to occur in the wet season only (December to May) to maximise the water available to fill the reservoirs and reduce the risks of significant downstream dewatering.
- Avoid 'flat lining' of the Cisokan River flow by constant minimum flow flow, the upper dam bottom valve which will be regulated periodically (for at least 10-14 days, and if possible along with new flows or floods), to increase discharge to maximum capacity 0.96 m^3/s outlet for periods lasting at least two days. This will "flush" the river, and minimize the risk of drying out the riparian habitat or the formation of algae growth. This water will be collected in the lower reservoir so that there is no reduction of water in the Pumped Storage system by this flow regulation.
- Open the bottom outlet of the lower reservoir periodically (at least 10 - 14 days and if possible in conjunction with new flows or flooding) to increase discharge to a maximum outlet capacity of 13 m3 / s, during a period lasting at least one day, to 'refresh' river.
- Monitoring the quality of water, fish and river habitats will be carried out before filling and during filling to determine the impact and changes to the residual flow rates if needed.
- Coordination with the Cihea Irrigation Scheme to ensure that their irrigation water needs during the wet season are achieved, even if this results in a slower filling time for the UCPS.
- Flow management, water quality monitoring and habitat during inundation will be documented in the Reservoir Preparation Plan and the Operational Environmental and Social Management Plan. With these efforts, the potential impacts on river biodiversity can be minimized.

13.7.2 Erosion and Sedimentation in Upper Dam and Lower Dam

Erosion and Sedimentation in Upper Dam and Lower Dam resulting from inundation processes.

Mitigation:

Clearing the soil surface and strengthening receding land with vegetation in the inundated area before the inundation process is carried out.

13.7.3 Downstream Users of the Cisokan River

The potential for reduced water flow flowing to downstream users from the lower dam.

Mitigation:

The inundation process is carried out in accordance with the e-flow regime detailed in Section 4.6. Consultation to be carried out with the Cihea Irrigation Scheme members prior to and during the inundation period.

13.7.4 Community Connectivity (Bridge Access)

The bridge that passes through the lower reservoir (near the Jolok block resettlement and Gunung Batu), if the connecting bridge between the Jolok block resettlement to the Margaluyu village (Cianjur Regency) is submerged; the community only has an access road to Rongga District meaning that travel to Cianjur Regency takes a longer.

Mitigation:

Construction of alternative roads or replacement bridges

13.8 Environmental and Social Management Mitigation Operational Stage

13.8.1 Hydrology, River Flow Discharge, and Water Availability for UCPS Downstream Users

Changes in discharge patterns and flood frequency in the downstream UCPS area.

Mitigation:

1. Ensure procedures for the implementation of consultations with downstream users, regarding changes in flow to downstream areas, are carried out.
2. Follow the e-flow regime as detailed in Section 12.2.
3. Coordinating with the Cisokan Weir Manager (Cisuru Weir) to regulate the water discharge that will be used for UCPS operations and the water needs of the Cihea irrigation area.
4. Monitor the upstream discharge of the Upper Cisokan Hydroelectric Power Plant (on the Cirumamis and Cisokan Rivers) and the water levels in both reservoirs continuously. Monitoring stations should be installed as quickly as possible to ensure reliable data records.
5. Use daily water flow monitoring data to adjust the operation of bottom outlet valves on both dams so that the outflow equals the inflow, minus the water that is stored to replace evaporated water.
6. Channel water for the lower reservoir to the top of the upper reservoir during times of low flow, to ensure that the natural flow regime (where inlet discharge equals outflow) is maintained at all times.
7. Surveying the low-flow conditions of the Cirumamis and Cisokan Rivers, to understand the potential impact of biodiversity on further reduction of wetlands during the dry season. Consider monitoring results to adapt the e-flow regime set new minimum future flows if relevant.
8. Operate emergency flood procedures to minimize downstream risks.
9. Providing education to downstream users regarding the potential for reducing the amount of flood flow, flood emergency procedures, and low flow conditions.

13.8.2 River Habitat, Erosion and Sedimentation

The upper and lower reservoirs will trap sediment in the dead storage area over its lifetime. The nature and scale of impacts within the reservoir and downstream in the Cisokan River may be significant but are yet to be quantified. Downstream there may be changes in erosion and sedimentation patterns which could affect land adjacent to the rivers and could change flood risk.

Mitigation:

1. Assessing the nature and scale of impacts from reduced sediment load in the Cisokan River, proposed sediment management in the lower reservoir and appropriate mitigation measures. This requires analysis of the proposed sediment management, surveys of baseline riverbed and bank and modelling of the likely changes in bedload, erosion potential and the identification of 'hotspots' or risk areas for erosion and deposition of sediment.
2. Implementing the outputs and recommendations as part of reservoir and river management.

13.8.3 River Water Quality

Decreasing water quality and changing river habitat in the Cisokan river, especially with respect to increased levels of contaminants from domestic waste and suspended solids.

Mitigation:

1. Clearing of vegetation, removing pollutants and other reservoir preparation activities
2. Stabilization of potential landslide zones, prior to inundation, to minimize sediment contribution.
3. Replant secondary forest in greenbelt areas, reducing the potential and impact of discharge from settlements and agriculture along the coast of each reservoir.
4. Constant inflow and outflow of water through both reservoirs, reducing water quality problems associated with stagnant water.
5. Prohibition of fishing activities in the reservoir, eliminating nutrients due to leftover fish feed so that water quality problems get better.
6. The daily displacement of water from the upper and lower reservoirs will lead to aeration of water, reduce storage time and prevent oxygen and temperature stratification in both reservoirs.
7. Regulations regarding sanitation, reducing (at least in the short term) the human population in the watershed and reducing the use of rivers for toilets should result in reduced waste of fecal coliforms, *E. coli* and metals such as zinc and copper.

13.8.4 Land Use Changes in Transmission Line 500 kV Corridor

Changes in land use in the corridor of the 500kV transmission line have led to changes in surface runoff, erosion-sedimentation, food reserves, feed supply and timber potential.

Mitigation:

Changes in land use, in the corridor of the 500kV SUTET line, have led to changes in surface runoff, erosion-sedimentation, changes in food reserves, feed supply and timber potential.

13.5.7 Impact of Transmission Line on Public Perception

The public is worried about the impact that will be caused by the existence of the SUTET and the cable network between the routes.

Mitigation:

Conducting intensive outreach to the public regarding the extent of the impact caused by the transmission line.

13.8.5 Electric and Magnetic Fields (EMF) of the Transmission Line

There is a potential impact on people living or working near the transmission network in the form of electric and magnetic fields from the transmission network, which can have an impact on health or cause damage to electrical equipment.

Mitigation:

1. Public awareness schemes providing information about the impact of transmission lines on health.
2. Checking the amount of electromagnetic radiation regularly along the transmission line.

13.8.6 Biodiversity Impact Mitigation of the Transmission Infrastructure

Impacts from transmission infrastructure will be mitigated through the mitigation hierarchy with a focus on avoidance (especially of collision and electrocution risk), mitigation (especially of habitat fragmentation effects), and offsetting of residual impacts. The risks for biodiversity from the transmission line remains poorly understood and follow up studies are required tp qualify and quantify risks and develop appropriate mitigation actions. Key actions based on transmission line risks from other parts in the world include the following. Their relevance for the UCPS project needs to be determined in a separate Biodiversity Management Plan for the Transmission Lines, but are discussed here to provide PLN with a basis for designing mitigation strategies:

- Bring line design in line with avian-safe structures, using appropriate horizonal and vertical cable spacing
- Insulate energized parts
- Apply anti-perch structures
- Create canopy bridges where mammal mortalities occur
- Wire-marking to avoid collisions
- Monitoring of animal fatalities by checking along entire length of transmission lines
- Surveillance of inspection roads, protected BIA and Working zones for poaching, hunting, timber harvesting etc. with the cooperation of local landowner
- Install and maintain signs banning hunting, snaring and other activities that could harm protected wildlife,
- Community consultation regarding conservation, and risks of encroachment and over exploitation of forest resources
- Offsetting strategy to compensate for forest habitat losses of species that trigger Critical Habitat

13.8.6.1 Mitigating animal electrocution

Reducing power line electrocutions is a raptor conservation priority worldwide. The best strategy is to bury the power lines underground, but this is estimated to be significantly more expensive than above-ground infrastructure, especially for high voltage lines (Prinsen et al. 2012). If burying power lines is not an option, physical separation between distribution structures that prevents animals from touching two structures simultaneously is a key mitigation strategy. APLIC (2006) recommends a minimum of 152 horizontal centimeters (cm) and 102 vertical cm of separation between phase-to-phase and phase-to-ground contacts in the vicinity of a likely perch. Structures meeting APLIC's recommendations for raptors are described as "avian friendly." Above 230kV, engineering considerations usually dictate operational safety clearances that exceed recommended avian spacing recommendations (MWH and Stantec 2018).

Retrofitting for avian-safe structures can include one or more of the following strategies (APLIC 2006):

1. Line design or configuration: Increasing separations to achieve adequate separation for the species at risk. When the power line is located within the distribution area of large raptors or storks, this distance should be increased to 1.4 m;
2. Insulation: Covering conducting elements and/or covering grounded parts with materials appropriate for providing incidental contact protection to birds. It is best to use suspended insulators and vertical disconnectors. If upright insulators or horizontal disconnectors are present, these should be covered. The height of insulated chains should be more than 0.70 m;
3. Applying perch management techniques: Avian electrocution risk is lower for transmission structures than distribution poles because engineering requirements necessitate larger clearances (APLIC 2006). For transmission lines, APLIC (2006) recommends an additional 0.5 cm of separation for each additional 1kV over 60kV. Transmission line ratings reflect the phase-to-phase voltage differential; the phase-to-ground voltage differential is smaller. The phase-to-ground voltage can be calculated by dividing the line voltage by the square root of three (1.732) and should be used to determine the appropriate phase-to-ground clearance for transmission lines (MWH and Stantec 2018).

An additional key mitigation measure to prevent primate electrocution is permanent insulation of the wires (Lokschin et al. 2007). While this requires additional investment from the power company, it avoids expensive power outages when animal electrocution causes short-circuits. The following structures require different insulation measures (Prinsen et al. 2012):

- Terminal structures - All terminal structures should be constructed with sufficient insulation on jumper wires and surge arrestors.
- Strain structures (where jumpers are used) - At least two jumper wires should be suspended below the cross-arm, and the third jumper insulated. Alternatively, all jumpers should be insulated.
- Take-off structures - Switches should be designed so that perching by birds on switch gears is unlikely, and/or all dangerous components are insulated. Switch gears should be mounted below the cross-arm. Alternatively, insulated perch sites are installed well above the switch gear over the whole length of the transmission line.

- Intermediate structures with horizontal configuration of lines - Large enough to accommodate the wingspan of the largest perching bird species in the country, if all three phases are above the cross-arm. Alternatively, two outer conductors should be suspended below cross-arm.
- Intermediate structures with vertical or 'delta' configuration of lines - Large enough to accommodate the 'tip-of-toe to tip-of-beak or outstretched wing' or 'head-to-foot' dimension of largest animal species present (leopard).

Anti-perch devices can be useful to prevent birds from perching and potentially getting electrocuted, but they need to be carefully positioned and shaped so that they do not force birds to perch even closer to energized parts. Alternatively, if many birds are attracted to the nesting opportunities provided by transmission towers, and removal of such nests is costly, the provision of artificial nests has shown to be a cost-effective way to reduce natural nests (natural nests decay quickly and can cause short circuits) (Shimbun 2017).

Furthermore, maintenance of natural canopy bridges, and the preparation of artificial canopy bridges over the roads and over or under electric power supply lines could further minimize mortality of primates and other arboreal mammals in forest patches (Lokschin et al. 2007, Al-Razi et al. 2019). This requires regular patrolling of transmission line routes to look for electrocuted animals and determine whether alternative crossing structures such as canopy bridges could guide animals away from transmission infrastructure. Community monitoring along powerlines further helps identify electrocution hotspots, so that mitigation measures (e.g., arboreal bridges) can be spatially applied (Lokschin et al. 2007).

13.8.6.2 Mitigation of Bird Collision

Although different bird species fly at different heights above the ground, there is general consensus that the lower power line cables are to the ground, the better for preventing bird collision. There is also consensus that less vertical separation of cables is preferred as it poses less of an 'obstacle' for birds to collide with **Error! Reference source not found.**). Horizontal s eparation of conductors is therefore preferred (Prinsen et al. 2012).

Figure 125. A 400 kV line, with all conductor wires in the same horizontal plane. This picture also demonstrates the almost invisible thin earth wire (black arrow) in top (Photo: EWT-WEP) (Prinsen et al. 2012).

The most frequently used measure is wire-marking, which alerts birds to the presence of power lines and provides them with more time to avoid the collision (Janss 2000). Since the assumption is that birds collide with overhead cables because they cannot see them, fitting the cables with devices to make them more visible to birds in flight has become the preferred mitigation option worldwide. Besides thickening, coating or colouring the often least visible, thin ground wires, a wide range of potential 'line marking' devices have been developed, including: spheres, swinging plates, spiral vibration dampers, strips, bird flappers, aerial marker spheres, ribbons, tapes, flags, fishing floats, aviation balls and crossed bands. There is generally a lack of quality evaluative research of the effectiveness of these devices at the international level, but the evidence to date suggests generally positive results (Prinsen et al. 2012). Jenkins et al. (2010) conclude that, barring some notable exceptions, "any sufficiently large form of marker (which thickens the appearance of the line at that point by at least 20 cm, over a length of at least 10-20 cm), placed with sufficient regularity (at least every 5-10 m) on either the ground wires (preferably) or the conductors, is likely to lower general collision rates by 50-80%". Barrientos et al. (2011), who reviewed 21 wire-marking studies, similarly conclude that wire marking reduced bird mortality by 55-94%.

13.8.6.3 Mitigating Habitat Loss and Fragmentation from Transmission Line

The key mitigation strategies that compensate for the direct and indirect impacts to Critical Habitats are:

1. Reducing impacts from forest fragmentation, unauthorized and illegal land clearing away from the road, and illegal hunting.
2. Offsetting the areas directly and indirectly affected by transmission line infrastructure to ensure net gain for the habitat of Critically Endangered species, following ESS6.

Where the transmission line passes through *Perhutani* land, the collaboration between PLN and *Perhutani* through the renewed PKS should ensure that *Perhutani*, as the legal authority for these forest areas, implements actions that prevent illegal logging and hunting, including the placement of signposts, patrolling of forest edges and areas, community outreach, and law enforcement.

13.8.7 Reforestation, Ecological Connectivity and Forest Management

PLN has prepared the Biodiversity Management Plan (BMP) to manage the direct and indirect impacts of the Cisokan Hydropower project on the condition of biodiversity, and for the maintenance of project-affected areas. Integrated management of biodiversity has been applied in areas known as Restoration Areas, which include 15 Biodiversity Important Areas (BIAs), six corridors and buffer zones. The establishment of a restoration area will have an impact on the livelihoods of the local population due to restricted access to these areas. Therefore, an agreement must be made on a 'middle ground' to compromise biodiversity conservation efforts with controlled access for local people to support their livelihoods.

The BMP document provides practical guidance in several ways including reducing threats to biodiversity, managing identified risks, involving communities and stakeholders, organizing related institutions that aim to manage restoration areas collaboratively, pro-actively supporting the development of knowledge about conservation of biodiversity.

The objectives of the BMP are as follows:

1. To protect and enhance the remaining forest communities (both in terms of habitat and wildlife), so as to form an independent ecosystem.
2. To protect and increase the population of endangered.
3. To take into account ongoing threats to biodiversity conservation, from communities and village development, in the selection and implementation of conservation strategies.
4. To form a common understanding among stakeholders and local communities about the value of biodiversity and the threats that accompany it.
5. To provide controlled access for local people to use resources sustainably, in certain restoration areas, based on a precautionary approach.

Based on the BMP Action Plan, there are five aspects that need to be considered by PT PLN, and each of these aspects has several programs that need to be carried out by PT PLN in collaboration with related stakeholders.

1. The direct impacts associated with the construction process will be reduced and managed by:
   a. Defining Biodiversity Important Areas (BIAs), corridors and buffer areas as restoration areas either within or adjacent to the project site, and reducing disturbance to these areas.
   b. Protect the restoration area from poaching and illegal extraction.
   c. Perform reforestation of disturbed areas in the project site and restoration areas.
   d. Educating local communities about biodiversity conservation initiatives by forming a common understanding between stakeholders and local communities about the value of biodiversity and the threats that accompany it.

2. Afforestation and forest management will be carried out by:
    a. Revegetating the restoration area using suitable plant species, as recommended in the BMP Action Plan.
    b. Ensuring the availability of sufficient plants, including the suitability of species / varieties in the nursery managed by the local community.
    c. Build agroforestry systems for local income.
    d. Protect remaining wildlife habitats through habitat improvement and species enrichment, including improving ecological connectivity between forest patches and other ecosystem functions.
    e. Protect forest areas from encroachment, illegal logging, and illegal hunting.
    f. Develop mechanisms and designs that incorporate the benefits that people get from forest management.

3. Wildlife management will be carried out by:
    a. Ensuring that wildlife with the status of rare or endangered, and other protected animals, can survive and / or increase their population size by reducing direct or indirect threats through prevention and mitigation of habitat destruction, preventing disturbance and death of wild animals, and poaching.
    b. Preventing (reducing) conflicts between humans and wildlife due to the use of shared resources (food sources) and predation of livestock owned by local residents by wildlife.

4. Stakeholder participation will be carried out and managed by:
    a. Increasing knowledge, awareness, and participation of local stakeholders in the management of Upper Cisokan, including biodiversity conservation activities.
    b. Improving coordination and cooperation between PLN internal and between PLN, *Perhutani*, the local government, and local communities related to ICM.
    c. Harmonizing the activities of the various parties (PLN, *Perhutani*, and local communities) taking place in project-affected areas, to optimize the protection of wildlife and their habitats as well as the livelihoods of local residents.
    d. Seeking political support with the aim of obtaining funding and resources which can then be allocated to finance the management of the Upper Cisokan.

5. Community participation will be carried out and managed by:
    a. Involving the local community to ensure that they can contribute to the management planning of Upper Cisokan and benefit from the development of the area.
    b. Integrating the BMP into resettlement planning and highlighting potential opportunities for resettlement areas to contribute to reforestation efforts, and to achieve more successful and sustainable livelihood restoration programs.
    c. Ensuring that any livelihoods negatively impacted by BMP activities will be handled by the World Bank under the World Bank ESF.
    d. Increasing activities that can generate income for local communities in accordance with the conservation of biodiversity in the restoration area and management of the Upper Cisokan.

Increase the sustainability of land use managed by *Perum Perhutani* through sustainable land cultivation by local communities. Based on the results of the review and gap analysis on the implementation of the BMP action plan, general recommendations for improving the implementation of the BMP action plan in the future are as follows:

1. Implementation of the BMP action plan needs to be carried out based on a priority scale according to the pre-construction, construction and operational phases.
2. Extension (and revision if necessary) of the MoU between PLN and *Perum Perhutani* need to be carried out immediately so that revegetation activities in working zones 1, 2, and 3 can be carried out in accordance with the BMP action plan.
3. It is necessary to strengthen institutions and governance systems that are responsible for implementing the BMP action plan and the necessary resources.
4. Planning for revegetation programs along with targets (number of seeds needed, successful growth, types of plants, location of planting) needs to be made more systematically, with more attention to the recommendations (updated) of the BMP action plan.
5. Revegetation and reforestation programs need to be structured in a more planned and systematic manner, starting from nurseries and seedlings maintenance, planting and maintenance in the field, monitoring and evaluation of planting activities. The community is a key provider of seeds, providing opportunities other than planting and maintaining plants.
6. Community empowerment in monitoring activities against the emergence of disturbances in reforestation and revegetation areas, as well as in efforts to prevent and control forest and land fires.
7. It is necessary to establish a reporting system in case of incidents involving wild animals (traffic accidents, exposure to electricity, poaching) and encounters with wild animals.
8. It is necessary to develop the principle of benefits for the local community in relation to the existence of working zones 1, 2 and 3 with the principle of sustainable use of local natural resources. For example, through the development of agroforestry systems.
9. It is necessary to evaluate the placement and design of artificial corridor features / infrastructure, particularly rope bridges, including across water ways to reduce further forest fragmentation impacts.
10. It is necessary to conduct socialization and counseling with BBKSDA periodically in order to protect the existence of endangered and protected wild animals, along with law enforcement for those involved in hunting and / or trafficking of rare and protected wild animals illegally.
11. Increasing the capacity of work units with adequate resources that specifically manage water catchment areas and restoration areas.
12. The formation of a multistakeholder coordinating body needs to be initiated at the relevant Ministry level (BUMN, KLHK, ESDM) to coordinate the handling of various problems that occur, whose scope is outside the authority of PLN and *Perum Perhutani*.
13. Build cross-sectoral collaborative networks in order to find alternative sources of funding for environmental management (biodiversity conservation, community capacity building, and local economic development) in the UCPS Project Area.
14. Awareness, education, and information programs need to be structured in a planned, systematic and routine manner. For this reason, the work unit that is specifically responsible for implementing the program needs to be re-established within PLN .
15. The BMP action plan is integrated into the resettlement plan documents.

16. The community economic recovery program, especially for those affected by the construction of the UCPS hydropower plant, needs to be carried out in a planned manner with measurable targets. The priority of local economic development is directed at developing production systems based on local natural resources, such as agroforestry and natural tourism. Sources of funding outside PT. PLN (Persero) need to be explored, including through the CSR (Corporate Social Responsibility) scheme of companies located in the administrative areas of West Bandung Regency, Cianjur Regency and West Java Province.

13.9 Grievance Mechanism

The SCMP contains the details of the grievance mechanism.

13.10 Reporting

External reporting by PLN is required as shown in **Table 124**.

Table 124 Reports and Reporting Requirements

Type of Report and Purpose	Frequency of Reporting	Receiver of Reports
The ESMP updates (including any changes in management and monitoring procedures) and any sub-plans prepared under the ESMP.	As required, prior to implementation For approval before implementation	• DLH (Environment Agency) West Java Province • DLH (Environment Agency) Cianjur Regency and West Bandung Regency World Bank
ESMP implementation progress, including: **Progress to date and upcoming events** **Significant issues (ongoing, new, emerging, closed)** **Environmental and social monitoring and survey data collected that month.** **Recommended updates and adaptations to management plans.** **Stakeholder engagement activities and issues** **Incidents - statistics**	Monthly detailed reports. Quarterly overview as part of Project reporting.	World Bank

Type of Report and Purpose	Frequency of Reporting	Receiver of Reports
Grievances **Training**		
Lost time injury incident or workplace death or significant environmental event or incident, including significant breach of laws, discovering the archaeological site, human remains or artifacts	Within 24 hours after the incident (according to the incident procedure, which outlines the severity of the incident requiring reporting)	• DLH (Environment Agency) Cianjur Regency and West Bandung Regency The World Bank
Major changes in project activities that may affect Environmental Approval	Within 1 week after identification of important event	• DLH (Environment Agency) West Java Province World Bank
Incident reports **for minor incidents that have been corrected. Includes grievance reporting.**	Once a year.	• DLH (Environment Agency) Cianjur Regency and West Bandung Regency
	Monthly as part of monthly reporting	World Bank
Non-compliance reports	Every year	• DLH (Environment Agency) West Java Province
	Monthly as part of monthly reporting	World Bank
Implementation of Electricity Safety (K2)	Every 3 month	• Department of Manpower (Disnakertrans) Cianjur Regency and West Bandung Regency

13.11 Capacity Development

This management plan shall be implemented within PLN's Environmental Management System for Upper Cisokan. The management system (to be developed) with provide PLN with the systems and structures to enable implementation of the plan, monitoring, reporting and delegation of roles to third parties.

13.11.1 Training

All those responsible for the management and implementation/operation of any aspect of the ESMP shall be adequately trained for their role. Evidence of training will be maintained on site, for inspection/auditing purposes.

PLN will maintain a training schedule, and procedure for keeping records. Records of training attendance and training programs shall be kept and be available for inspection/auditing. The Contractors will also maintain their own training schedule and records.

PLN with the Environmental Unit internally, has some well-trained and experienced people who can develop, implement, monitor, evaluate and report on the ESMP. External training, and/or the use of third-party contractors or consultants will be required to develop the in-house capacity and gap-fill the skills and resources in technical areas such as biodiversity management and environmental monitoring.

The Supervision Engineer has a requirement to train the ESHS staff of PLN Engineering and UPK to supervise C-ESMP and may also provide targeted training to the contractors, based on need.

Table 125 Capacity Building for Construction Phase

Implementer	Training Scope	Purpose/Objective	Training Material	Trainees/ Audience	Schedule & Budget
Supervision Engineers	Implementation and Monitoring of ESMP	• The requirements of the ESMP • How to execute the environmental requirements of the project, • How to supervise, monitor and audit • How non-compliance with the ESMP will be handled,	• Key issues covered in ESMP • The agreed environmental monitoring checklist, • The environmental monitoring form • Particular attention will be paid to the specific provisions in each contract's technical specifications indicating how the ESMP is to be complied with • Regulation	• Environmental Supervision Engineers, • PLN staff, • Contractor's Safety and Env. Officer • Workers as part of the training given to the SEO	• Construction phase. • The budget allocated in Supervision Engineers' contract
	• Health and Safety	• The health and safety requirements mentioned in ESMP • Health issues identified by the Contractors	• Key issues covered in ESMP • The agreed environmental monitoring checklist, • The ESHSl monitoring form • Health and safety provisions in each contract's technical specifications • Regulation	• Supervision Engineers, • PLN staff, • Contractor's Safety and Env. Officer • Workers as part of the training given to the SEO	
	• Hazardous Substances Management and Emergency Procedures: must be trained in handling, spill and emergency procedures	How to handle, implement dan monitoring the hazardous substances and emergency procedures	• Key issues covered in ESMP • General Hazardous Procedures • Hazardous Materials Storage • MSDS Requirement • Emergency procedures • Hazardous and Emergency Regulation	All staff involved in the handling and use of chemicals, fuel and explosives (Contractor, Supervision Engineers, PLN)	

Implementer	Training Scope	Purpose/Objective	Training Material	Trainees/ Audience	Schedule & Budget
	• Concrete and Asphalt management	How to implement Concrete and Asphalt management in handling, spill, dust, water and emergency procedures.	• Key issues covered in ESMP • Emergency procedures • Procedures to handle spill, dust and water.	All staff involved in the manufacturing, transport and handling of concrete and asphalt (Contractor, Supervision Engineers, PLN)	
	• Sediment Control, and Control of Discharges	• To manage the impact of Construction, and maintenance • To manage the environmental protection • To monitor discharge	• Key issues covered in ESMP • The control of discharge and Sediment Control procedures	• The officers in charge of construction, maintenance and monitoring (Contractor, Supervision Engineers, PLN)	
Contractors	OSH training and capacity training for each activity that has risk.	To ensure all staff are trained and have suitable skills and experience to avoid and manage risks while carrying out their tasks.	• In-house materials, task-specific.	• Workers	• Construction phase. • The budget allocated in Contractors' contract
	• Safe control and driving of heavy road-construction vehicles •	To ensure safe passage during and after working hours	• Procedure of Safe control of road traffic • Procedure of driving the heavy road-construction vehicles	• The management of traffic officer • Drivers • Pedestrians in and around the project construction areas	• Construction phase. • The budget allocated in Contractors' contract
	Training and awareness programs	The safety risks regarding road construction and heavy vehicle operations.	• Brochure • Leaflet	The community, including school children	
	• Concrete and Asphalt management	How to implement Concrete and Asphalt management in handling, spill, dust, water and emergency procedures.	• Key issues covered in ESMP • Emergency procedures • Procedures to handle spill, dust and water.	All staff involved in the manufacturing, transport and handling of concrete and asphalt	
	• Hazardous Substances Management and Emergency Procedures:	How to handle, implement dan monitoring the hazardous substances and	• Key issues covered in ESMP • General Hazardous Procedures • Hazardous Materials Storage	All staff involved in the handling and use of chemicals, fuel and explosives	

Implementer	Training Scope	Purpose/Objective	Training Material	Trainees/ Audience	Schedule & Budget
	must be trained in handling, spill and emergency procedures	emergency procedures	• MSDS Requirement • Emergency procedures • Hazardous and Emergency Regulation		
	• Sediment Control, and Control of Discharges	• To manage the impact of Construction, and maintenance • To manage the environmental protection • To monitor discharge	• Key issues covered in ESMP • The control of discharge and Sediment Control procedures	• The officers in charge of construction, maintenance and monitoring	
PLN • **By External specialists (forest ecology, primate ecology, and fish ecology)**	Biodiversity management	How to implement the biodiversity management plan	• Biodiversity Management Plan, • Options, strategy of the Plan	PLN Staff	• Prior to main Construction implementation • The budget provided in ESMP App. 10
PLN • **By archaeologists**	Cultural heritage	How to manage cultural heritage finding and the appropriate protection techniques and procedures for relocation of the documented religious facilities and graves	• Procedure of Chance finding	• Officers of Contractor • Officers of Supervision Engineer • PLN Staff	• Prior to main Construction implementation • The budget provided in ESMP App. 10

Table 126 Training for Inundation and Operation Phase

Implementer	Training Scope	Purpose/ Objective	Training Material	Audience	Schedule & Budget
PLN • **By External specialists (forest ecology, primate ecology, and fish ecology)**	• Biodiversity Management	Understanding the theory and practicalities of: • reestablishing indigenous habitats in buffer zone areas, • the protection of buffer zone areas and the reservoirs from occupation, for safety reasons.	• Theory and practicalities of managing habitats for primates • Biodiversity Management Plan • Management Model 1-5	PLN Environmental Unit staff	• Prior to main Construction implementation • The budget provided in ESMP App. 10

Implementer	Training Scope	Purpose/ Objective	Training Material	Audience	Schedule & Budget
PLN **By External specialists (ecologists and hydrologists)**	• River habitat management	Understanding the theory and practicalities of: • ecology and habitat of rivers, • the habitat changes due to sediment and flow changes downstream • adaptive management.	• The methods to monitor habitat condition and change downstream of reservoirs. • Instream monitoring and data interpretation. • Adaptive river management.	PLN Environmental Unit staff	
	• Environmenta l flows downstream	Understanding the theory and practicalities of environmental flows downstream of each dam.	• The relevant procedures for measuring and maintaining environmental flows	All staff involved in operating the power station	
	Dam safety	Understanding the operations and maintenance manuals and emergency management procedures.	• Management plans	All staff involved in operating the power station	

13.12 **Plan Monitoring and Review**

The PLN Environmental Unit will periodically monitor and audit the effectiveness and implementation of the plan whether a document review is required. Audit programs and procedures include the scope, frequency and methods as well as the responsibilities and requirements for conducting audits and reporting results.

The frequency of audits reflects the level of significance of environmental impacts and the results of previous audits.

13.12.1 ESMP Review

The ESMP will be reviewed periodically to evaluate environmental and social controls and procedures to ensure they remain applicable to activities. The review will be carried out by the PLN Environmental Unit, as follows:
- The complete ESMP will be reviewed at least annually.
- Relevant parts of the ESMP will be reviewed following a re-labeling incident.
- The relevant parts of the ESMP will be reviewed upon receipt of the updated sub-plan.

- At the request of stakeholders, including Government Bodies (BPLHD), Contractors, Supervisory Engineers or host communities.

The ESMP review will include analysis of data collection and results, monitoring reports, incident reports, complaints, feedback from stakeholders, Government Agency reports (BPLHD), minutes of consultation meetings and training notes, to evaluate the effectiveness of the procedure. Field visits, interviews and other audit methods can also be used.

The ESMP update, after review, will follow the procedure in Section 9.2.

13.12.2 New Impacts and Activities

All new activities and impacts that are not covered by the main ESMP or any sub-plans, should be included and new revisions of the plan resulting through the update procedure.

13.12.3 ESMP Control and Updates

The ESMP will be issued as a 'controlled document' to all relevant staff and organizations. The procedure to be followed to control the issue of the documents, provide a review of its effectiveness and provide updates is as follows:

1. Issued copies by the Environmental Unit of PLN will be numbered.
2. The Environmental Unit will initiate a review of any relevant sections following modification to the Environmental Approval, issue of a new approval, or a change to internal procedures based on corrective actions or improvements in methodologies.
3. The Environmental Unit will ensure the document is reviewed and that all sections are up to date.
4. Any parts of the ESMP that require Government Agency approval will be lodged with the relevant agencies and may not be implemented until an approval has been provided.
5. All controlled copies will be updated following a change, coordinated by the Environmental Unit.
6. All updated sub-plans will be forwarded to the Environmental Unit in order to update the relevant appendices in this plan.
7. Updates will be communicated to all interested and affected stakeholders.

13.12.4 Government Agency Review

All reports, registers and monitoring results must be made available to the Government Agency (BPLHD) on request. The Government Agency (BPLHD) must have the ability to audit the results and carry out duplicate monitoring or auditing at any time to ensure compliance with the ESMP and any approvals issued.

Where the Government Agency (BPLHD) does not have the capacity to audit, PLN shall ensure that an independent audit is carried out at the request of the Government Agency (BPLHD) and to their satisfaction.

13.12.5 World Bank Review

The implementation of ESMP will be submitted quarterly to World Bank for review.

All ESMP revision will be submitted to World Bank for review and approval, before it is applied.

13.13 Estimated Costs

Table 127 Estimate of Costs to implement the ESMP and sub-plans

No	Description ESMP	Cost Estimated ($ US)	Remarks
1	**Contractor - Implementation of Environmental, Social, Security, Health and Safety Risk and Impact Mitigation** • Traffic management and safety • Occupational health and safety • Community health and safety • Environmental controls • Handling complaints • Public Relations • Environmental quality monitoring • Capacity training • Monitoring and review (review) • External communication / reporting • Procedure for protecting cultural objects and sites and chance find procedures • Biodiversity protection and revegetation within the work footprint • Social and public relations • Construction management and worker base camp • Transmission line ESHS management • Quarry ESHS management	$0	Included in the Contract with the Contractors
2	**Engineering Supervision - environmental, social, security, health and safety supervision of the Contractors..** • Supervising the implementation of C-ESMP.	$0	Included in the contract with the Construction Supervision Engineer.
3	**PLN Environmental Unit** • Salaries and wages • Official Travel Fee	$ 900,000	

No	Description ESMP	Cost Estimated ($ US)	Remarks
4	**ESHS Strengthening Institutions, Training and Capacity Building** • PLN Environmental Unit • Local government, communities and stakeholders • Onsite training • Offsite training • Capacity Development • equipment and logistics	$ 500,000	
5	**SCMP** • Stakeholder Engagement • Grievance mechanism • GBV • Economic empowerment program • Women's knowledge enhancement program • Household energy use assessment • Local labor employment support	$ 2,100,000	
6	**Technical Assistance Team to PLN Environmental Unit PHJ** • Consulting team to assist with the implementation of the Plans, updates and new plans, including BMP, River erosion and sedimentation study, Transmission Line studies and Management Plan, Operational Environmental and Social Management Plan and: • Manuals and procedures • Assist the development of environmental databases • Project Environmental and Social Management system • Assisting the development of PLN PHJ Environmental Unit • TORs • Incident management and response • GIS and other technical expertise	$4,000,000	
7	**Independent Environmental and Social Panel**	$1,000,000	

No	Description ESMP	Cost Estimated ($ US)	Remarks
8	**Biodiversity Management Plan and Forest Partnership Framework** • ICM facilitation team • Revegetation • Rescue operations • Provision of guards • Infrastructure and equipment • Education • Community based forestry	$8,000,000	First 5 years
9	**Dam safety planning:** Reservoir Filling Plan, Emergency Procedures, Dam Operations and Maintenance.	$0	Within the TOR of the Engineering Consultant (under Supervision Engineer)
	The total estimated ESMP cost (including SCMP) is:	**$16,500,000**	

CHAPTER 14. CONCLUSION

The Upper Cisokan hydropower project is designed to meet the peak load needs of the Java-Bali grid electricity system. The construction of this hydropower plant has a number of advantages to the Java-Bali network, including:

- Reduced dependence on expensive petroleum to meet demand during peak loads.
- Ability to use base load energy efficiently, during low loads.
- Providing assistance in controlling the load frequency of Cirata hydropower; so that it can be operated more efficiently.
- Providing a backup that can be operated immediately in the event of a failure of one of the generators or disruption of the transmission line.

Several ANDAL and EIA studies have been completed since project commencement. The ESIA report has compiled the results of the ANDAL, EIA studies and several technical studies completed between 2009 and 2020.

The Environmental and Social Management Plan and subplans have been prepared to manage mitigation efforts during the construction, inundation and operational phases of the UCPS. This includes the SCMP (including the SEP, LMP, GRM, GAP, and GBVAP) and BMP. It is considered that, if these measures can be implemented, the negative impacts of the project can be minimized. The measures outlined in the ES IA, ESMP, SCMP BMP and LARF ensure that development can be implemented and provide benefits to the Java-Bali power network. The SCMP which provides concrete guidance on mitigating stakeholder engagement, labor and gender issues during the project cycle.

The main environmental and social risks and impacts associated with the hydropower project are summarized below.

14.1 Resettlement

The Project requires approximately 731.76 ha of land for the access road, upper and lower reservoir, and transmission line. Approximately 310.14 ha of community and private land has been acquired for the UCPS hydropower plant development. Affected assets include houses, settlements, cemeteries, mosques, productive land, subsistence agriculture, fishponds and other small businesses. 1,549 households have been compensated for their land and other assets. There are 765 Household that must move from the impacted area. Approximately 409 ha of state forest land has been acquired, restricting the use of that land by locals who relied on it for agriculture, timber and non-timber forest products. The resettlement process or other social impact or compensation issues were managed through the LARAP. Implementation of the LARAPs has been reviewed by independent consultants and presented in standalone document of LARAP Implementation Review Report (2021).

In addition to community and private land an additional 409 hectares of Government-owned forest land have been acquired, restricting the use of that land by communities who rely on it for agriculture, timber and non-timber forest products (PLN Update, 2019).

14.2 Socio-Economic Benefits and Development Impact on Society

The construction period is estimated to last for at least five years. The UCPS construction will require hundreds of workers employed by the Contractors at any one time. Most are expected to come from elsewhere in Indonesia or overseas and will require accommodation in the Project area. During the peak construction there will be an influx of up to 2,700 workers and estimated 4,500-6,000 followers to the project area. Social risks related to construction may include noise, traffic hazards, dust, restriction of access to land, restricted access to infrastructure and resources, gender-based violence, and health problems, and disturbances from migrant workers and camp followers interacting with the local community.

The project will seek to mitigate gender risks (including GBV) and address gender gaps in the community through improving stakeholder outreach, engaging with local women's groups to raise awareness, and participation for project economic empowerment programs, including livelihood/business training, and various GBV awareness and training initiatives.

The construction of new roads and bridges has allowed access to remote villages and will continue to provide benefits to the local economy during the construction and operation stage. The scheme is anticipated to strengthen the rural base sector (agriculture, animal husbandry, fisheries and forestry) and to grow services and trade. It is recognized in the environmental objectives of the Forest Partnership Framework that implementing significant reforestation efforts will require a change in livelihoods from ones focused on short-term income generation from annual crops to ones more focused on longer-term benefits from agroforestry.

Other aspects, such as indigenous peoples (ESS7) are not triggered, and social impacts on downstream users is minimal throughout the construction cycle, with insignificant impacts on irrigation and fishing. Procedures for the implementation of consultations with downstream users (Cihea Irrigation Scheme), regarding changes in flow to downstream areas, will be carried out, to alleviate perceptions that UCPS will negatively impact on floods and droughts.

14.3 Biodiversity Impacts

The impact analysis concludes that in the UCPS project area, 400 ha of Critical Habitat will be directly impacted and 2,288 ha indirectly, while along the transmission line, 100 ha will be directly impacted and 341 ha indirectly. This results in total impact estimates on Critical Habitat of 500 ha of directly impacted areas and 2,629 ha of indirectly impacted areas. Taking into consideration the counterfactual trends, the area impacted is smaller, i.e., 1,867 ha.

The Biodiversity Management Plan (BMP) has been updated and supersedes the previous BMP publicly disclosed in 2011 as a sub-plan to the ESMP, as well as the BMP prepared but not published in 2015. The BMP provides practical guidance for reducing threats to biodiversity where practical, to manage identified risks, to engage with communities and stakeholders, and to pro-actively support the development of knowledge in biodiversity conservation using the ESS 6 mitigation hierarchy. Through this BMP, the aim is to engage with biodiversity professionals, government, the community, non-government organizations (NGOs), researchers and appropriate individuals to achieve a high standard of biodiversity and conservation management.

The Biodiversity Management Plan (BMP) is prepared to manage the direct and indirect impacts of the Cisokan hydropower project on the condition of biodiversity and for the maintenance of project-affected areas. It is implemented through an Integrated Catchment Management (ICM) approach that simultaneously addresses biodiversity, environmental and social aspects of landscape management. It provides a sound rationale for a range of actions that focus on (a) Construction-related impact mitigation and management; (b) Reforestation and forest management; (c) Wildlife management; (d) Stakeholder participation; and (e) Community engagement. Within the project area of influence the BMP goals are: (i) To achieve net gain of Critical Habitat and Natural Habitat; (ii) To protect and enhance the remnant forest communities (both the habitat and wildlife) to create a self-sustaining ecosystem; (iii) To protect and increase the populations of critically endangered and endangered species so that they are self-sustaining; (iv) To take into account the ongoing threats to biodiversity conservation from the community and rural development in the selection and implementation of conservation strategies; and (v) To create a common understanding amongst stakeholders and the community about the biodiversity values and threats.

Implementation of the ICM will through a Forest Partnership Framework aims to restore a connected (agro-)forest landscape across 3,800 ha of land around the UCPS reservoirs and project facilities. The most practical way to establish the ICM program will be to pursue a collaborative forest management option between PLN, local communities and Perhutani. This strategy would build on existing land use patterns and land ownership, facilitating a relatively easy entry point to get the principal ideas of ICM established and tested.

Fifteen (15) Biodiversity Important Areas (BIA) have been identified in the immediate project area, with a total area of about 425 ha. The BIAs are presently forested islands in a non-forest landscape. They provide insufficient ecological resources to sustain viable populations of threatened species. The 3,800 ha of restoration aims to provide a **net positive gain in biodiversity values,** offsetting the 500 ha of direct impacts on critical habitat and the 2,629 ha of indirect impacts on critical habitat, or 1,867 ha under the counterfactual scenario. It simultaneously aims to restore the terrestrial biodiversity component by significantly increasing ecological connectivity among forest areas, benefiting species that trigger the Critical Habitat criteria, such as Slow Loris and Grizzled Leaf Monkey, and the aquatic habitat by improving ecological conditions alongside tributaries flowing into the reservoirs. Finally, the restoration and offsetting strategies aim to fulfil socio-economic objectives through the development of financially viable social forestry and agroforestry programs. These aim to restore original agroforestry-based land uses in the UCPS area that provide communities with improved income and reduce ecologically damaging land practices, such as open field agricultural cultivation on steep slopes.

14.4 Environmental Impacts in Rivers Downstream of the Dam

During construction, sediment discharge will result in poor water quality and flow patterns. This will continue during the construction period and may result in sedimentation and/or reduced clarity of river water. Erosion, sediment management systems, and control of working in and around riverbanks and beds, and other discharge controls will prevent potential impacts as far as is practicable and are described in ESMP.

During inundation, the hydrological conditions of the Cirumamis and Cisokan Rivers will be temporarily affected, during the process of collecting water to fill the reservoir. Based on the estimated average conditions, and looking at the minimum discharge flow, the Upper Cisokan Hydroelectric Power Plant will fill the reservoir in ±122 days. To minimize potential impacts on downstream river users and river habitat, filling will be carried out during the rainy season. Up to $6.21m^3/s$ will be taken from the Cisokan River to fill the reservoirs, with the remaining water discharged below the dam. This residual flow will be within the normal wet season range and will be sufficient for the Cihea Irrigation Scheme for average flow conditions. If the season has dry periods then the scheme will discharge at least $1.7m^3/s$.

During operation, there should only be minor changes in the hydrological state downstream of the two dams, because the Upper Cisokan Pumped Storage Hydroelectric Power Plant does not have the capacity to store water or reduce the existing flow. The discharge from the lower reservoir will equal the inflow minus the water required to top up evaporative losses (approximately $0.2m^3/s$). This will be part of a standard operating procedure, which is to use bottom valves and spillways to discharge water. During low flow periods (at or below $0.75m^3/s$, a residual flow of $0.55m^3/s$ will be released downstream). During extreme low flow periods (at or below $0.01m^3/s$), a residual flow of $0.01m^3/s$ will be released downstream. There will be a slight reduction in peak flooding.

The Cirumamis River will not have any reduction in flow. During very low flow periods, at or below $0.01m^3/s$, the upper dam will release at least $0.01m^3/s$.

Changes in erosion and sediment patterns are predicted to occur downstream of the Cisokan River during operations, due to reduced sediment loads. The nature and extent of this impact will be determined during future studies. Lower dam design is being updated to ensure there is no significant scour erosion at the base of the dam from the release of water from bottom outlets and spillways.

14.5 Dam Safety, Security and Reservoir Management

PLN has prepared a packaged dam safety plan including: i) Construction Supervision and Quality Assurance Plan, ii) Instrumentation Plan, iii) Preliminary Operation and Maintenance Plan, and iv) Broad Framework for Emergency Preparedness Plan. They are required to provide the full-fledged Operation and Maintenance Plan and Emergency Preparedness Plan to the Bank and Panel of Experts not less than 6 and 12 months prior to the initiation of the first reservoir filling.

When operating, the tides observe daily fluctuations as high as 19 m in the upper reservoir and 4.5 m in the lower reservoir. With these fluctuations, the reservoir is not safe for use by the community, or for commercial businesses such as aquaculture. People are prohibited from entering the reservoir and greenbelt areas for their own safety. Warning alarms will be installed prior to generation or pumping, to warn of changes in reservoir water levels. The greenbelt will be restored with local vegetation to provide habitat for wild animals and will prohibited for settlement or agricultural activities.

CHAPTER 15. COMMITMENT TO FOLLOW UP STUDIES AND ACTION

The current ESIA comprehensively covers the known environmental and social baselines, impacts and mitigation strategies for UCPS. Nevertheless, the extensive studies and reviews have indicated areas of further improvement. PLN continues to assess and study environmental and social impacts and develop further mitigation and management plans as follows:

- PLN will refine and finalize the calculation of greenhouse gas emissions as per ESS3 as part of the economic analysis to be completed prior to World Bank appraisal.
- Assessing the nature and scale of impacts from reduced sediment load in the Cisokan River, proposed sediment management in the lower reservoir and appropriate mitigation measures. This requires analysis of the proposed sediment management, surveys of baseline riverbed and bank and modelling of the likely changes in bedload, erosion potential and the identification of 'hotspots' or risk areas for erosion and deposition of sediment. Terms of reference will be prepared and technical consultants will be engaged to complete the study and prepare an impact assessment on habitat, land and river uses and develop mitigation measures for the Operational Environmental and Social Management Plan. The work is to be completed at least one year prior to reservoir filling.
- Further studies on the baseline avifauna and terrestrial biodiversity in the transmission line area of influence and any further mitigation measures regarding the location and design of transmission infrastructure to avoid animal injuries and mortalities. A terms of reference will be prepared for specialist consultants to undertake field surveys in Indonesia, quantifying and qualifying collision and electrocution risks, model mortality and injury and update the biodiversity impact assessment and prepare the Transmission Line Environmental and Social Management Plan with biodiversity impact mitigation measures (and offsets, if required) as per ESS6. Work to be completed prior to the completion of the bid documents.
- An occupational health and safety management framework will be prepared prior to World Bank appraisal to comply with ESS2 regarding the risks and appropriate risk management for construction and operational phase workplace hazards.
- A risk assessment on the significant occupational and community health and safety hazards of each of the construction packages will be prepared by PLN with the support of the Supervision Engineer, and specific instructions on the approaches to risk identification and management will be prepared for the bid documents and contracts for future contracts and amended where necessary into the existing contracts. Risk assessments to be completed prior to the completion of the relevant bid documents for future contracts and prior to the Project effective date for existing contracts.
- A TOR will be prepared for consultants to undertake a risk assessment on the significant occupational and community health and safety hazards during operation of the hydropower scheme, transmission line and reservoirs. The consultants will prepare the health and safety management sections of the Operations and Maintenance manuals and provide training, at least one year prior to reservoir filling.
- Best practice measures for preparing the reservoir for impoundment, based on potential habitat and water quality impacts are to be developed. A terms of reference will be prepared for a consultant to review the existing land cover, hazards and risks

in the reservoir and to assess the potential biodiversity and water quality impacts from impoundment and daily fluctuation of water within the reservoir and provide recommendations on environmentally and socially acceptable methods for preparing the reservoir to avoid and minimize impacts during operation. The terms of reference will include the preparation of the Reservoir Preparation Plan. Completed at least six months prior to reservoir filling.

- Update the Framework Emergency Preparedness Plan prior to appraisal to reflect the requirements of ESS4.
- Operation and Maintenance Plan and the Emergency Preparedness Plan for dam safety, as per ESS4, will be prepared by PLN and submitted to the Bank and the dam Panel of Experts not less than 6 and 12 months prior to the initiation of reservoir filling.

CLOSING

This is the Final Report of the Environmental and Social Impact Analysis for the UCPS 1,040 MW Hydroelectric Power Plant Project. This report provides a complete and comprehensive picture of environmental and social conditions to facilitate planning and risk and impact management during the planning, construction and operation of the hydropower plant.

Jatinangor, April 2021

Faculty of Agroindustrial Technology–UNPAD

(Dr. Ir. Edy Suryadi, MT.)

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APPENDIX A. LIST OF ENVIRONMENTAL AND SOCIAL RISK MANAGEMENT INSTRUMENTS

Environmental and Social Management Plan (ESMP)

Biodiversity Management Plan (BMP)

Social and Community Management Plan (SCMP)

Forest Partnership Framework (FPF)

Land Acquisition and Resettlement Framework (LARF)

Land Acquisition and Resettlement Action Plan (LARAP)

APPENDIX B. MAPS OF UCPS PROJECT

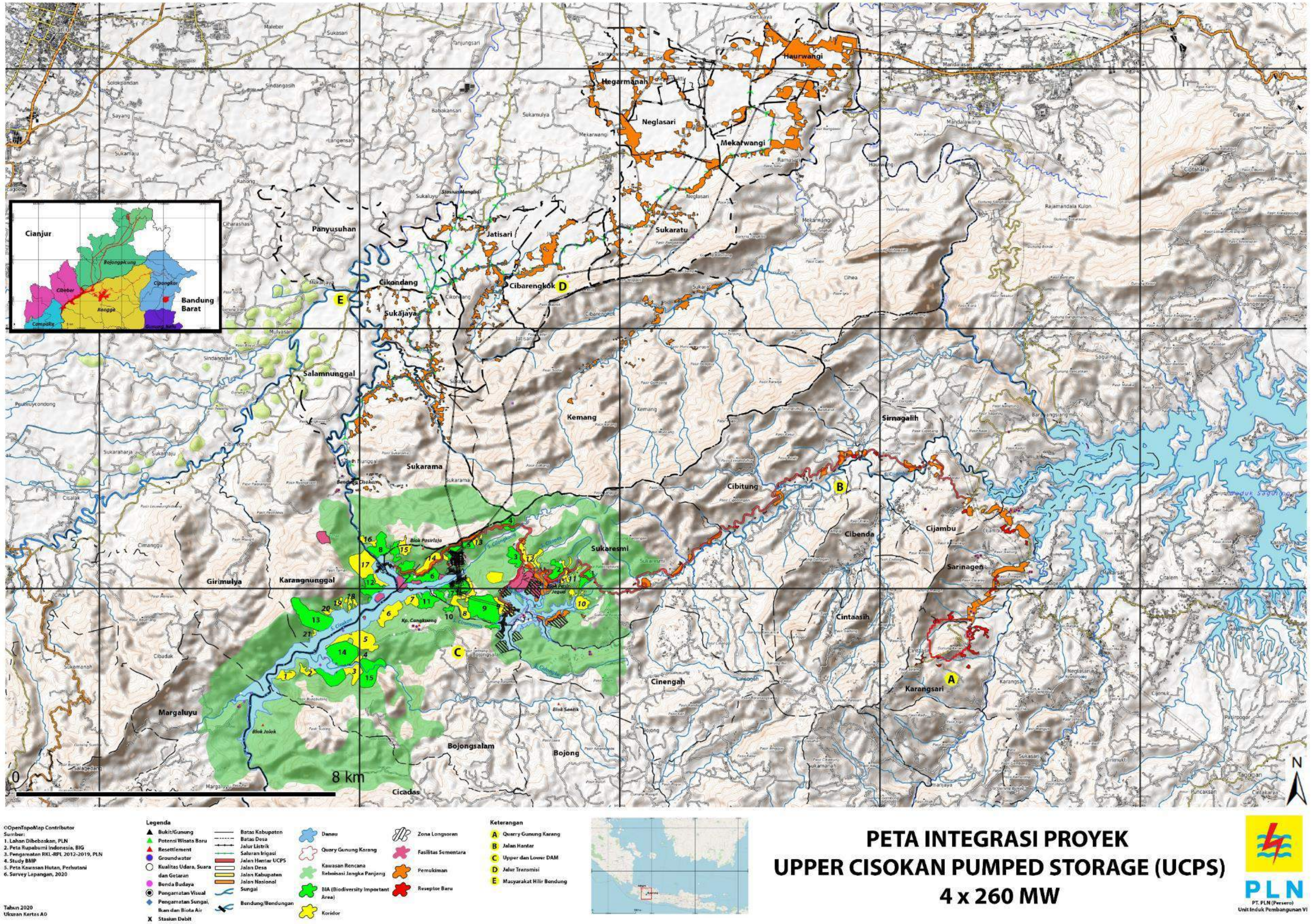


Figure B1. Integration Maps of UCPS Project

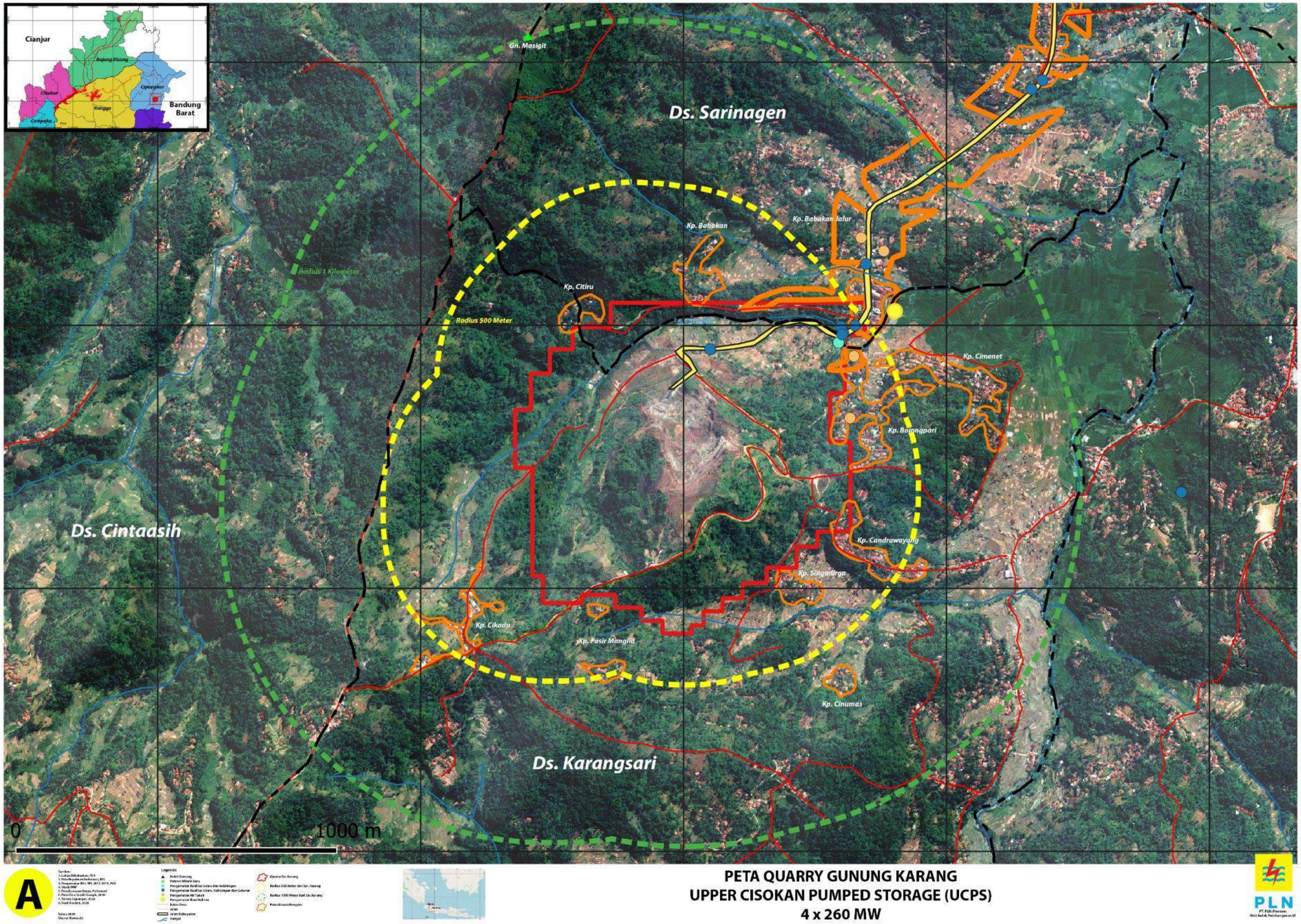


Figure B2. Quarry and surrounding landscape and land cover

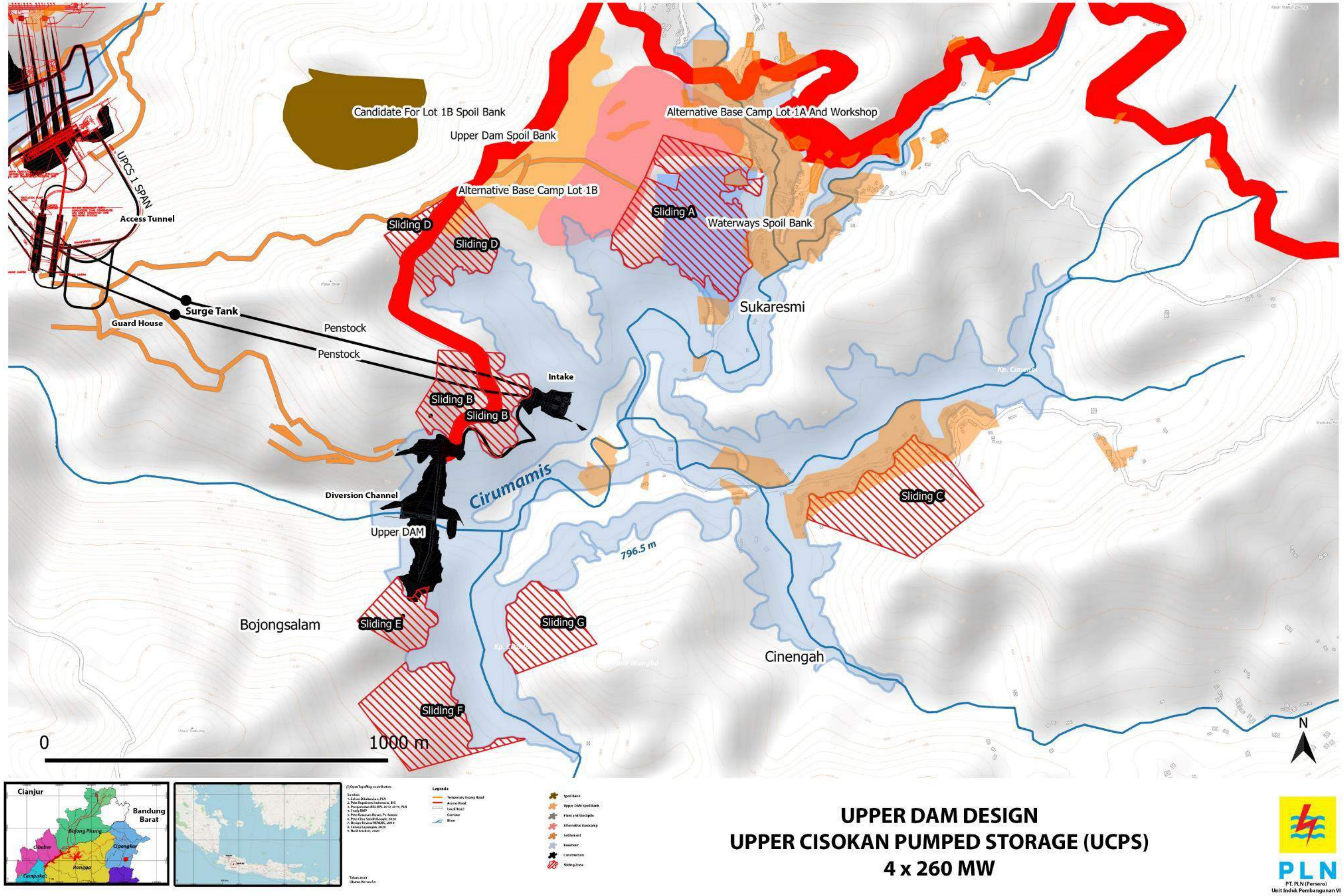


Figure B3. Upper Dam Design and Reservoir Plan

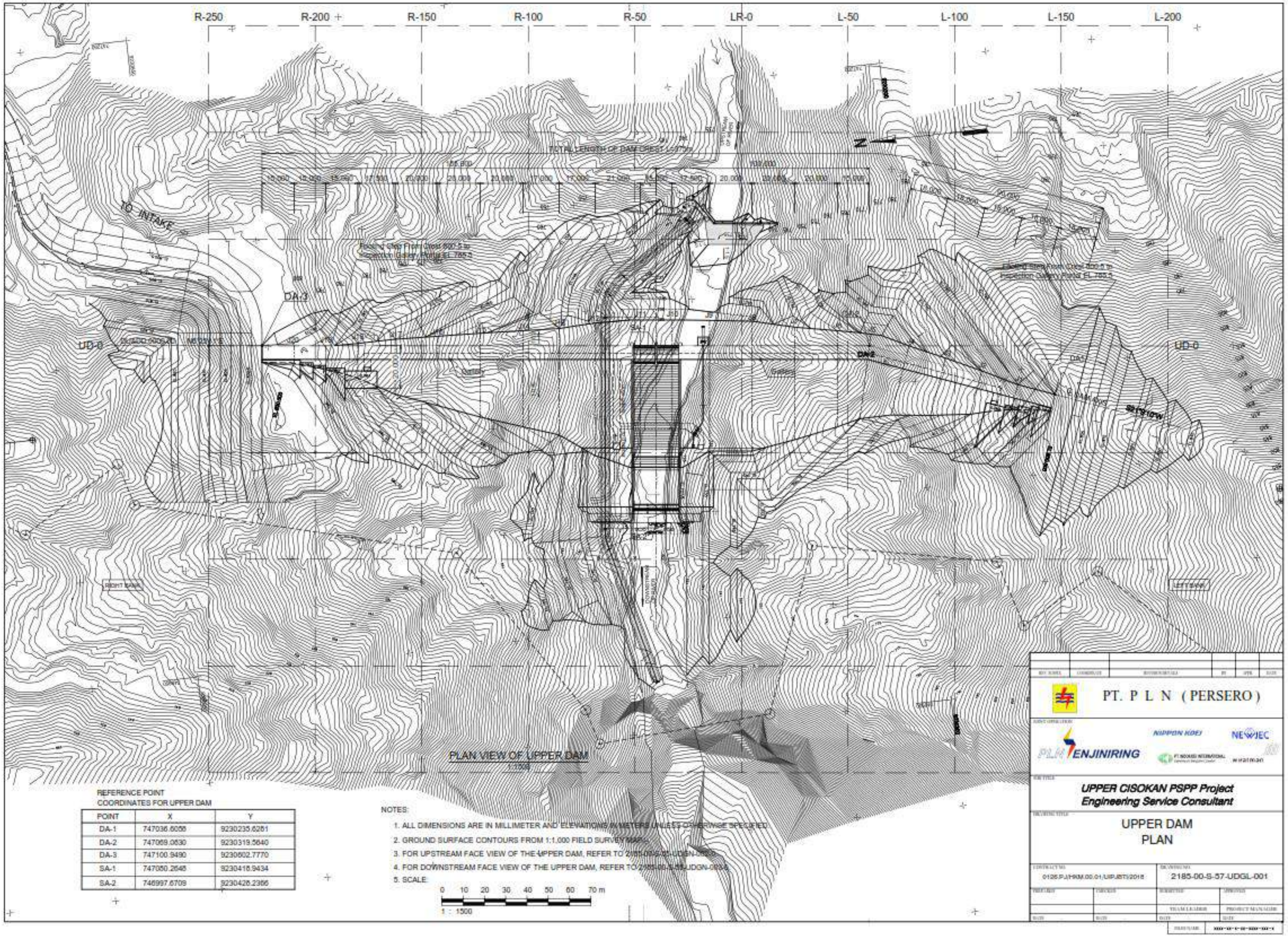


Figure B4. Upper dam engineering plan

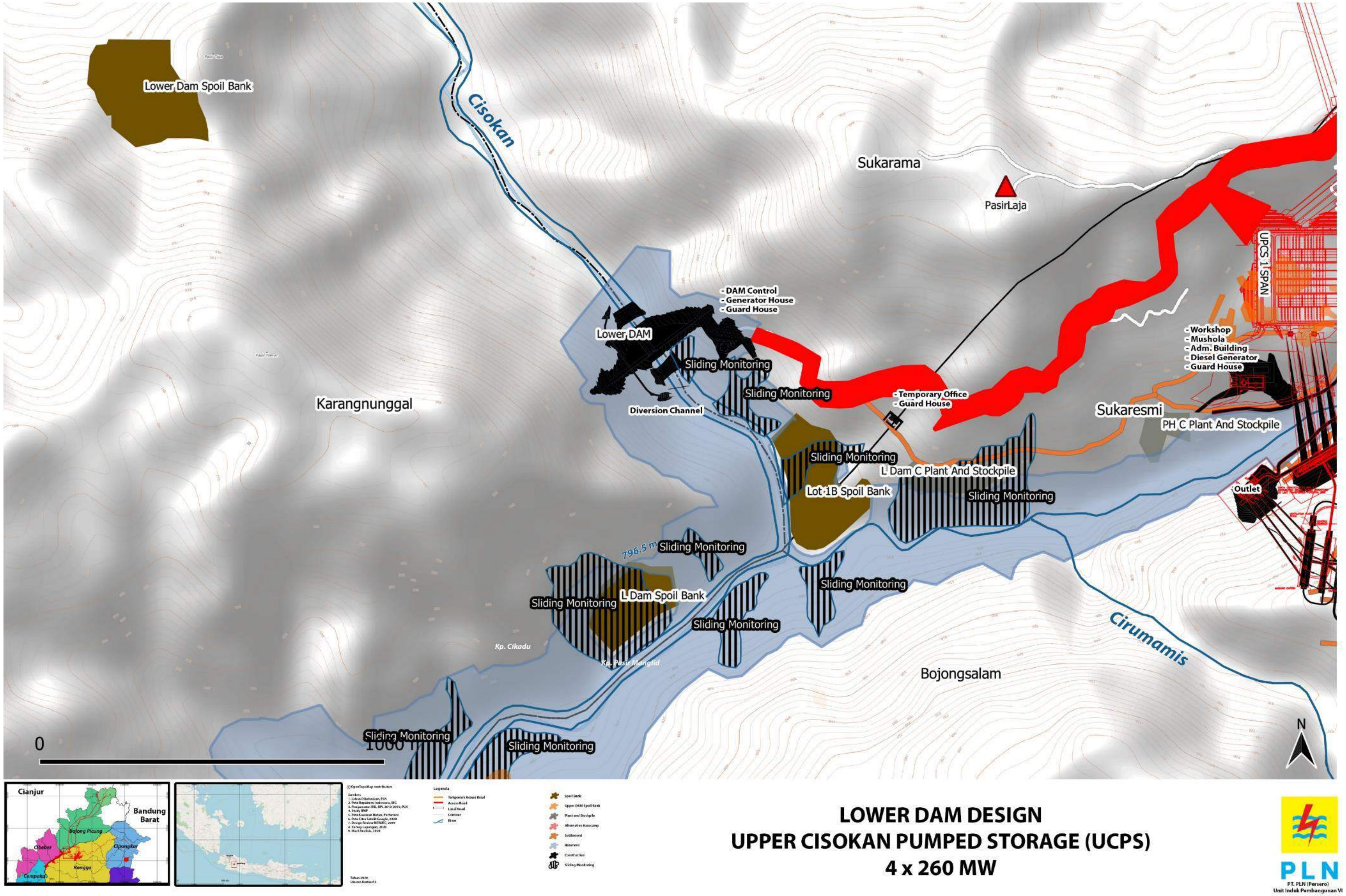


Figure B5. Lower Dam Design and Reservoir Plan

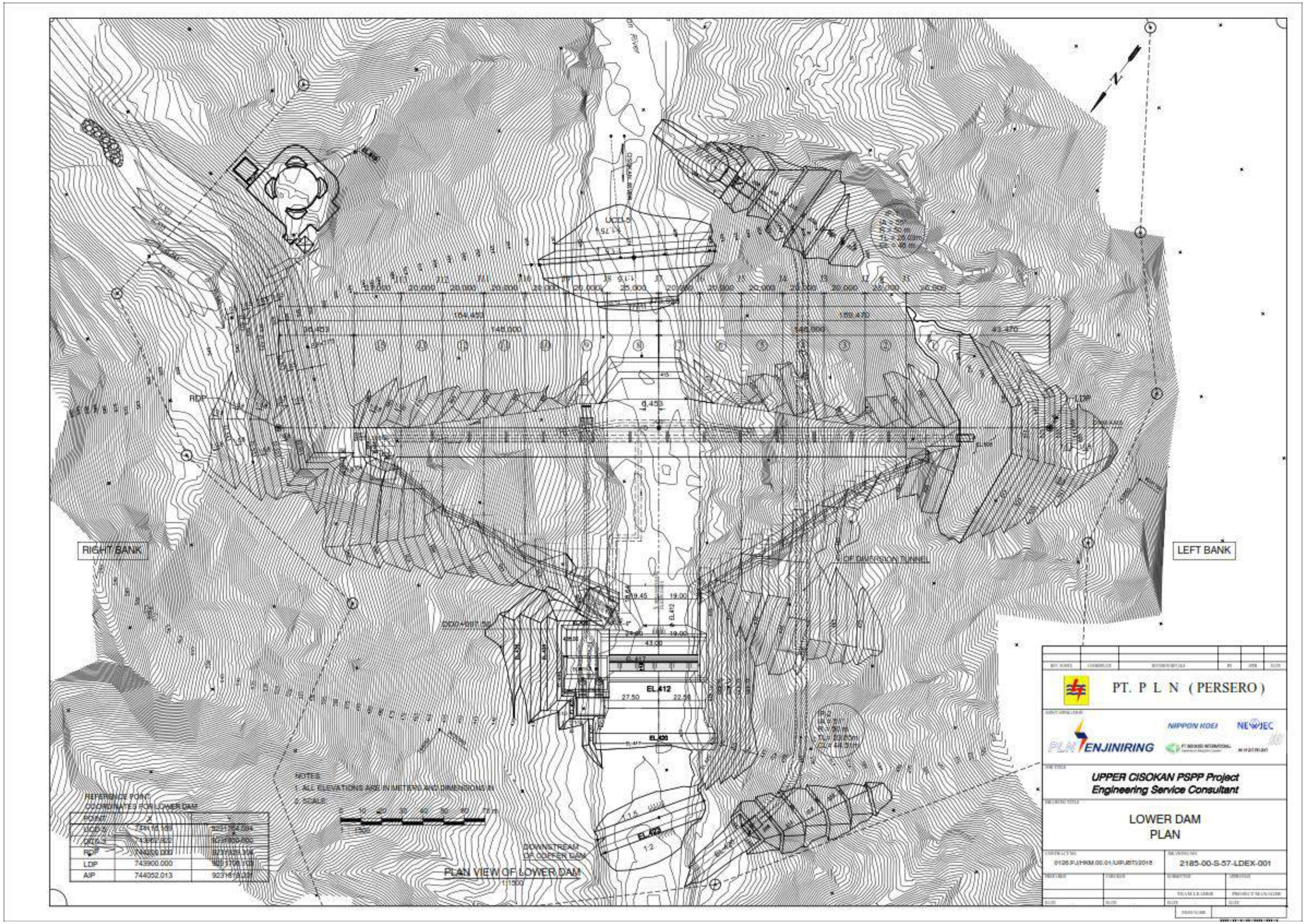
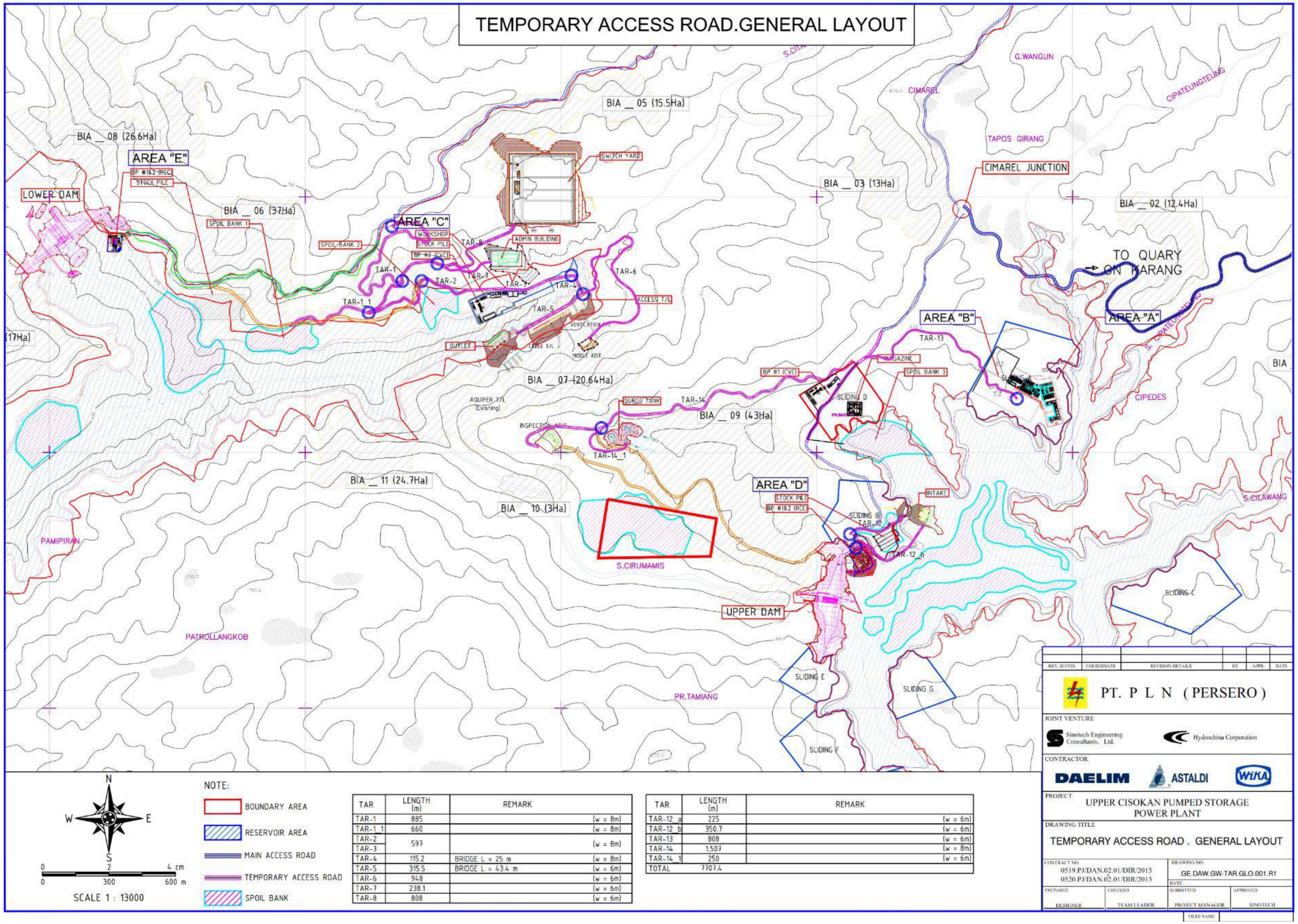


Figure B6. Lower dam engineering plan



TAR	LENGTH (m)	REMARK	
TAR-1	885		(w = 8m)
TAR-1_1	660		(w = 8m)
TAR-2	597		(w = 8m)
TAR-3			
TAR-4	115.2	BRIDGE L = 25 m	(w = 8m)
TAR-5	315.5	BRIDGE L = 43.4 m	(w = 6m)
TAR-6	948		(w = 6m)
TAR-7	238.1		(w = 6m)
TAR-8	808		(w = 6m)

TAR	LENGTH (m)	REMARK
TAR-12_a	225	(w = 6m)
TAR-12_b	350.7	(w = 6m)
TAR-13	808	(w = 6m)
TAR-14	1,507	(w = 8m)
TAR-14_1	250	(w = 6m)
TOTAL	7707.4	

Figure B7. Temporary Working Process during Construction Stage, including disposal site, basecamp or workers and sheet pile location

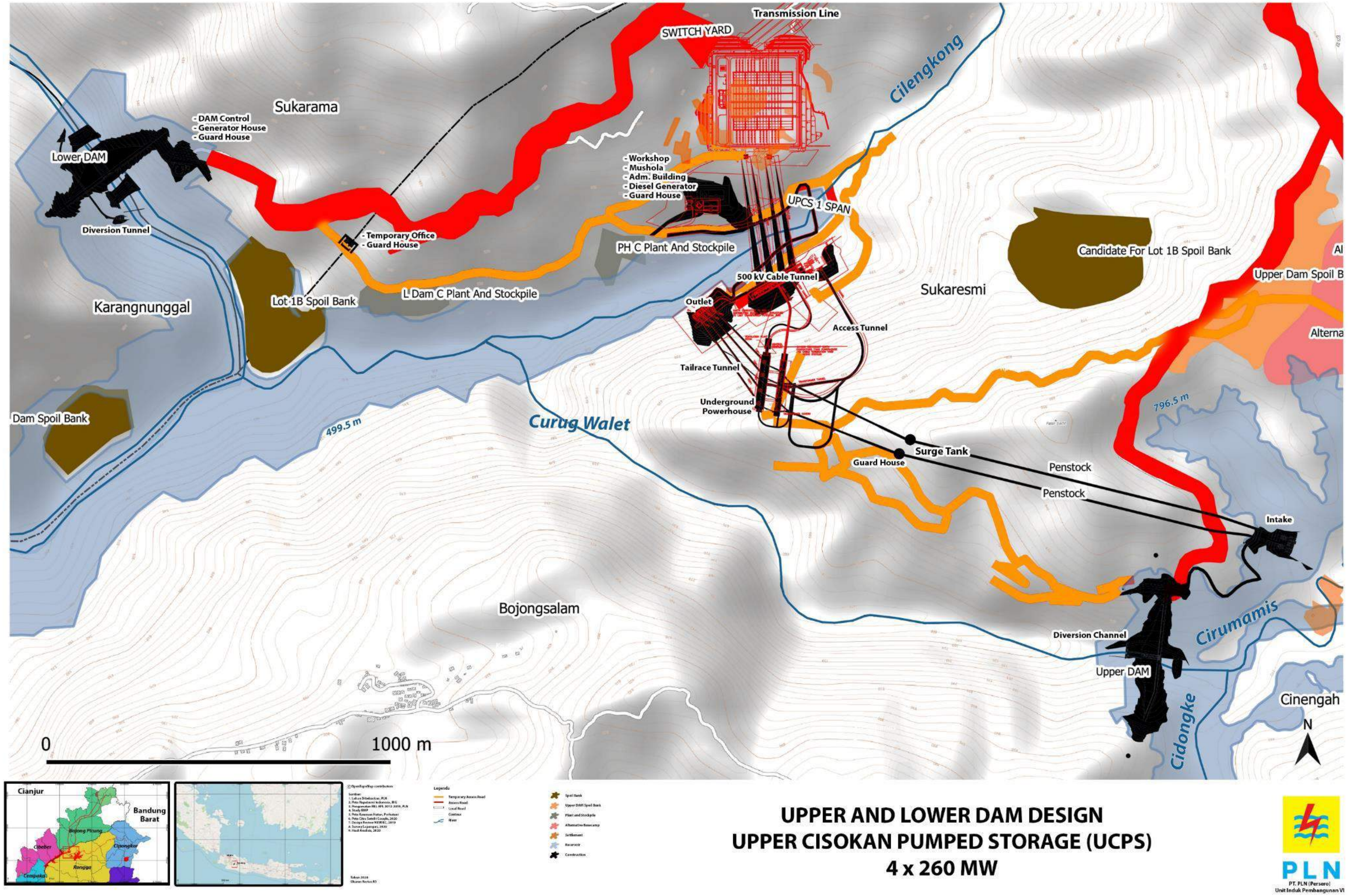


Figure B8. Upper and Lower Dam Design

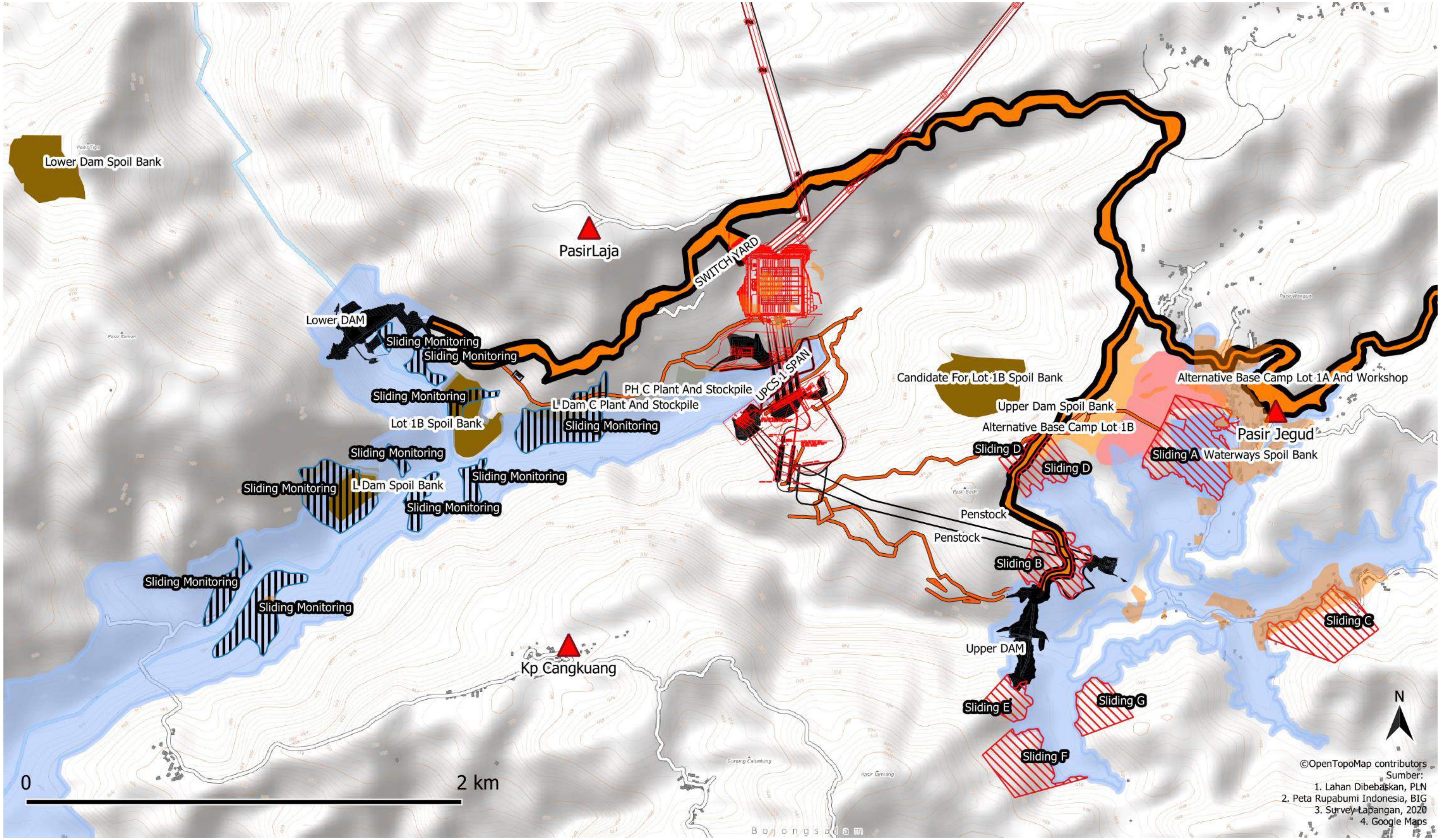


Figure B9. Sliding Zones and Slope

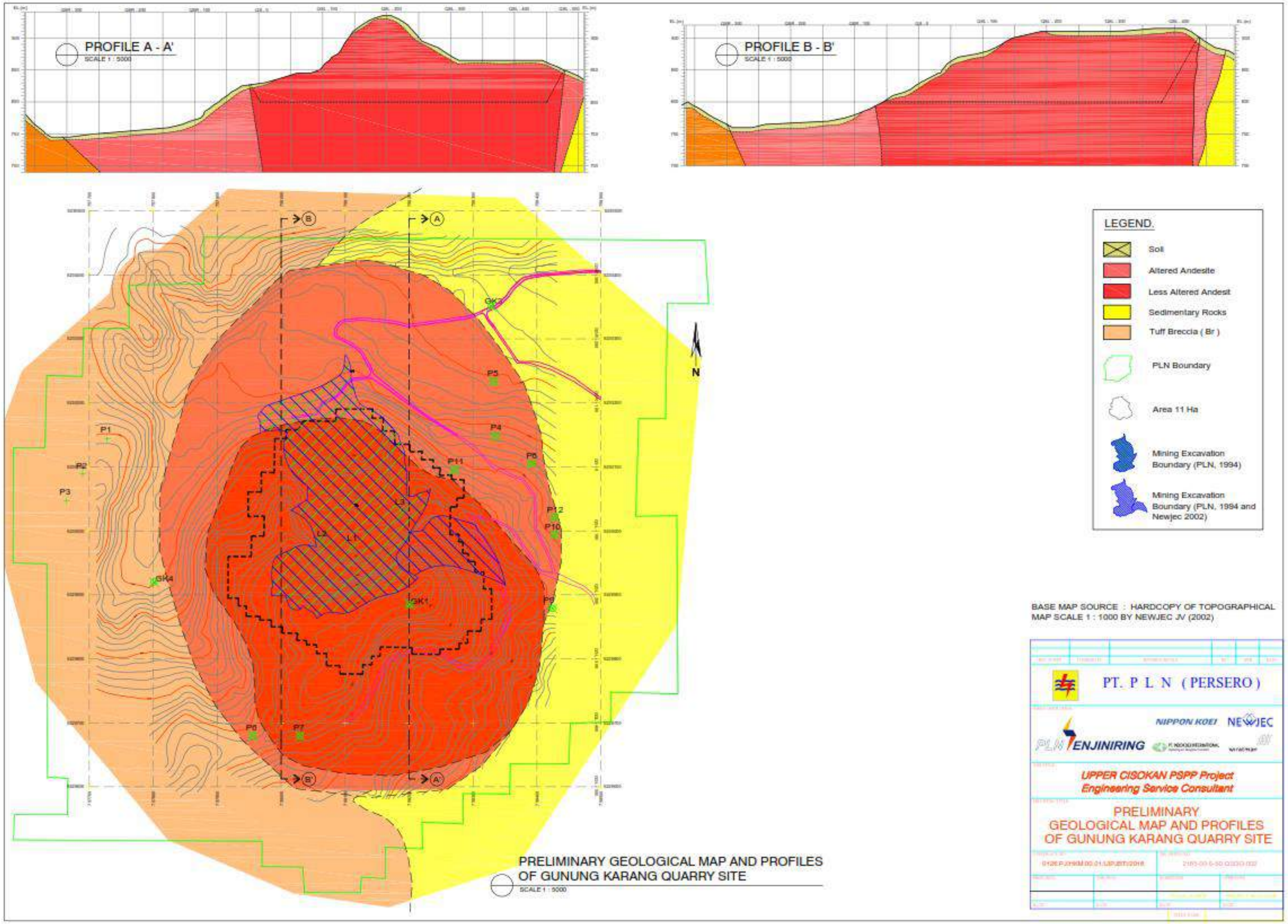


Figure B10. Quarry of Karang Mountain

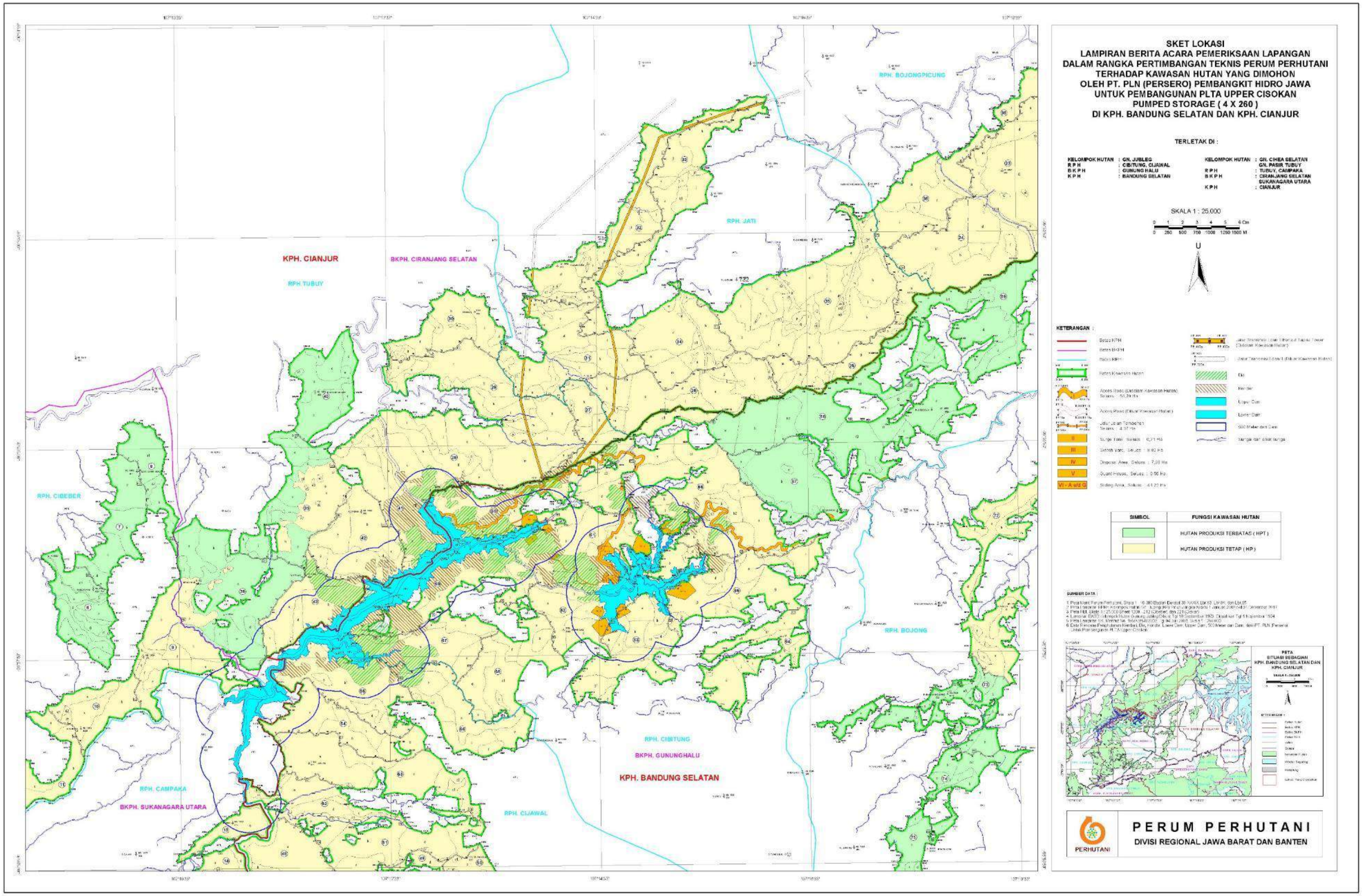


Figure B11. Forestry Use Zones in Project Area

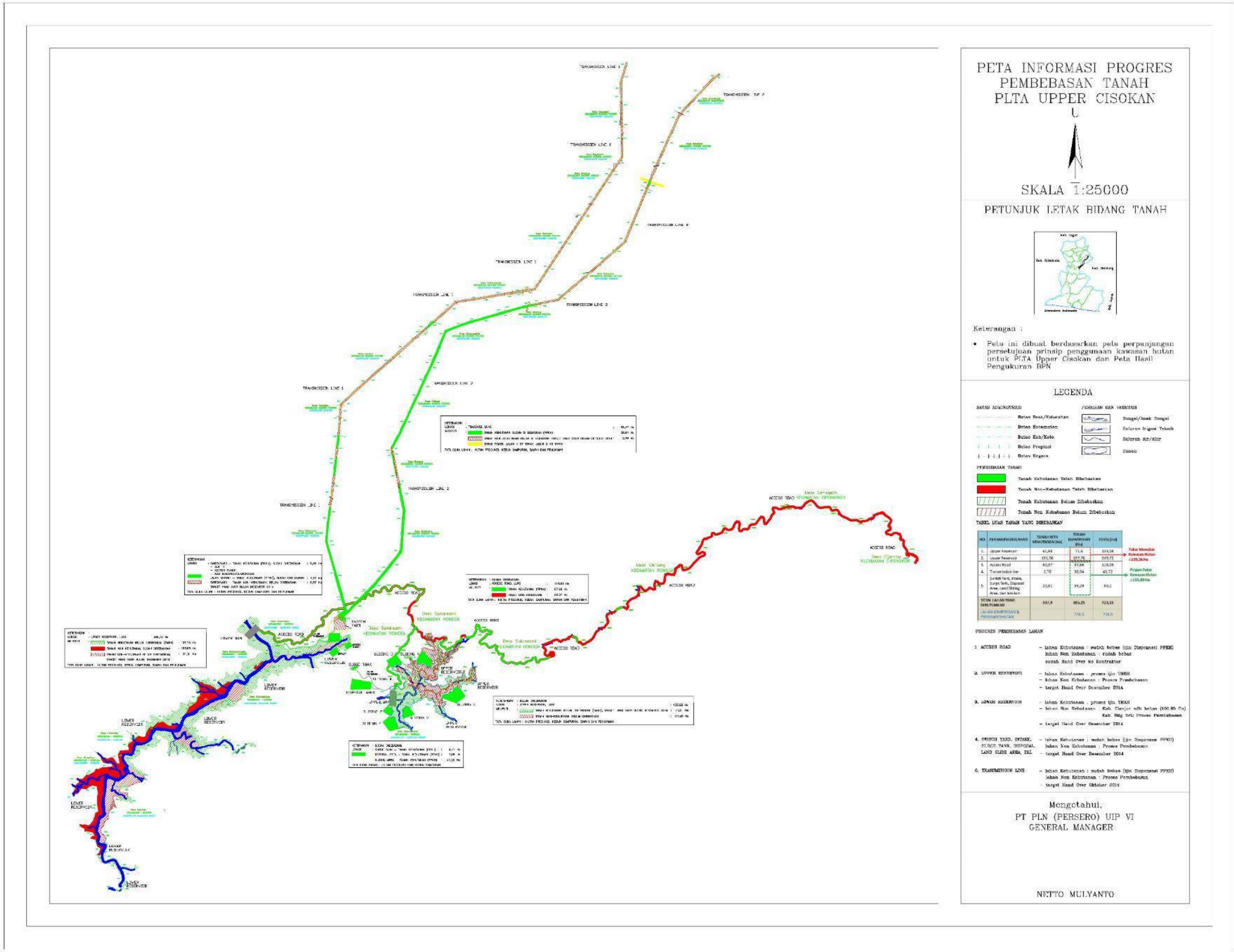


Figure B12. Acquisition land of UCPS Project

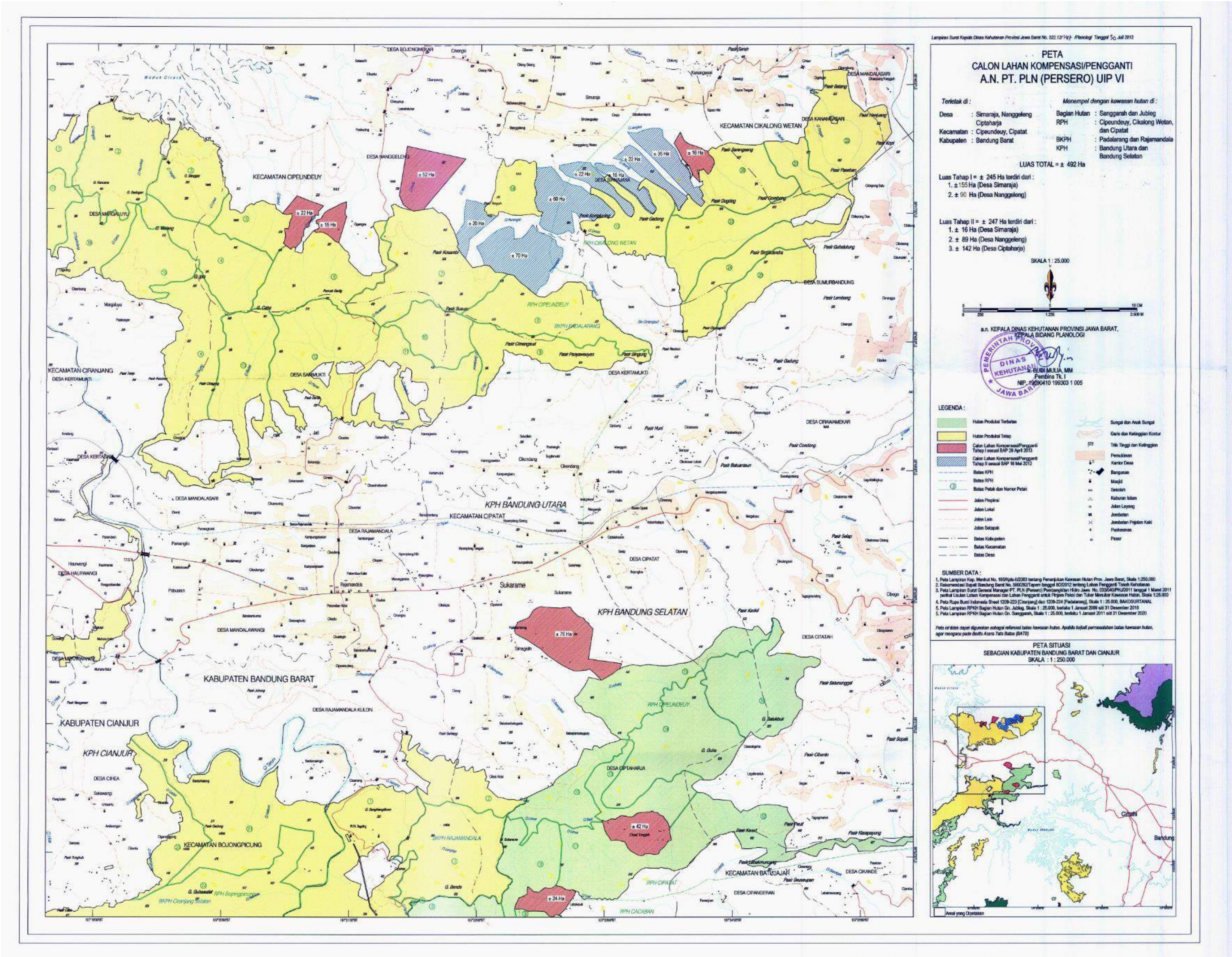


Figure B13. Prospective Replacement Land for Forest Area of West Bandung Regency

APPENDIX C. RULES AND REGULATIONS

APPENDIX C. RULES AND REGULATIONS

Legislative regulations that have been established by the government and become the legal basis for the preparation of the ESIA Development Report for UCPS, are as follows:

Rules and Laws

1. Law of the Republic of Indonesia No. 5 of 1960 concerning Basic Agrarian Regulations
2. Law of the Republic of Indonesia No.1 of 1970 concerning Work Safety
3. Law of the Republic of Indonesia No.5 of 1990 concerning Protection of Biological Natural Resources and their Ecosystems.
4. Law of the Republic of Indonesia No.23 of 1992 concerning Health.
5. Law of the Republic of Indonesia No. 5 of 1994 concerning the Ratification of the United Nations Convention on Biological Diversity (United Nations Convention on Biological Diversity)
6. Law of the Republic of Indonesia No. 41 of 1999 concerning Forestry.
7. Law of the Republic of Indonesia No. 13 of 2003 concerning Manpower
8. Law of the Republic of Indonesia No. 19 of 2003 on BUMN
9. Law of the Republic of Indonesia No. 21 of 2004 concerning the Cartagena Protocol concerning Biosafety of the Convention on Biodiversity
10. Law of the Republic of Indonesia No.40 of 2004 concerning the National Social Security System
11. Law of the Republic of Indonesia No. 26 of 2007 concerning Spatial Planning
12. Law of the Republic of Indonesia No. 40 of 2007 concerning Limited Liability Companies
13. Law of the Republic of Indonesia No.4 of 2009 concerning Mineral and Coal Mining as amended by Law No. 3 of 2020.
14. Law of the Republic of Indonesia No. 30 of 2009 concerning Electricity
15. Law of the Republic of Indonesia No.32 of 2009 concerning Environmental Protection and Management
16. Law of the Republic of Indonesia No. 36 of 2009 concerning Health
17. Law of the Republic of Indonesia No. 1 of 2011 concerning Housing and Settlement Areas
18. Law of the Republic of Indonesia No.2 of 2012 concerning Land Acquisition for Development for Public Interest
19. Law of the Republic of Indonesia No.6 of 2014 concerning Villages
20. Law of the Republic of Indonesia No.35 of 2014 concerning Amendments to Law No. 23 of 2003 concerning Child Protection
21. Law of the Republic of Indonesia No. 23 of 2014 concerning Regional Government
22. Law of the Republic of Indonesia No.2 of 2017 concerning Construction Services
23. Law of the Republic of Indonesia No. 17 of 2019 concerning Water Resources
24. Law of the Republic of Indonesia No.11 of 2020 concerning Job Creation

Government Regulations

1. Government Regulation of the Republic of Indonesia No. 7 of 1999 concerning the Preservation of Plants and Animals
2. Government Regulation of the Republic of Indonesia No.25 of 2000 concerning the Authority of Provincial Autonomous Regional Governments
3. Government Regulation of the Republic of Indonesia No. 16 of 2004 concerning Land Use Management
4. Government Regulation of the Republic of Indonesia No.45 of 2004 concerning Forest Protection
5. Government Regulation of the Republic of Indonesia No. 6 of 2007 concerning Forest Management and Formulation of Forest Management Plans, and Forest Utilization
6. Government Regulation of the Republic of Indonesia No. 38 of 2007 concerning the Division of Government Affairs, Provincial Government and District / City Government.
7. Government Regulation of the Republic of Indonesia No.3 of 2008 concerning Amendments to Government Regulation No.6 of 2007 concerning Forest Management and Formulation of Forest Management Plans and Forest Utilization.
8. Government Regulation of the Republic of Indonesia No.26 of 2008 concerning the National Spatial Plan
9. Government Regulation of the Republic of Indonesia No.60 of 2009 concerning Amendments to Government Regulation No.45 of 2004 concerning Forest Protection.
10. Government Regulation of the Republic of Indonesia No.10 of 2010 concerning Procedures for Designation and Function of Forest Areas.
11. Government Regulation of the Republic of Indonesia No.15 of 2010 concerning the Implementation of Spatial Planning.
12. Government Regulation of the Republic of Indonesia No.22 of 2010 concerning Mining Areas.
13. Government Regulation of the Republic of Indonesia No. 24 of 2010 concerning the Use of Forest Areas
14. Government Regulation of the Republic of Indonesia No. 72/2010 concerning State Forestry Public Company (PERUM).
15. Government Regulation of the Republic of Indonesia No.28 of 2011 concerning Management of Nature Reserve Areas and Nature Conservation Areas.
16. Government Regulation of the Republic of Indonesia No.27 of 2012 concerning Environmental Permits
17. Government Regulation of the Republic of Indonesia No.37 of 2012 concerning Management of Watersheds.
18. Government Regulation of the Republic of Indonesia No.60 of 2012 concerning Amendments to Government Regulation No.10 of 2010 concerning Procedures for Designation and Function of Forest Areas.
19. Government Regulation of the Republic of Indonesia No.61 of 2012 concerning Amendments to Government Regulation No.24 of 2010 concerning Use of Forest Areas.

20. Government Regulation of the Republic of Indonesia No.104 of 2015 concerning Procedures for Changing the Designation and Function of Forest Areas.
21. Government Regulation No. 105/2015 on the Second Amendment to Government Regulation No. 24/2010 concerning the Use of Forest Areas.
22. Government Regulation of the Republic of Indonesia No.108 of 2015 concerning Amendments to Government Regulation No.28 of 2011 concerning Management of Nature Reserve Areas and Nature Conservation Areas.
23. Government Regulation of the Republic of Indonesia No. 88 of 2019 concerning Occupational Health

Presidential Regulation

1. Presidential Regulation of the Republic of Indonesia No. 32 of 1990 concerning Management of Protected Areas
2. Presidential Regulation of the Republic of Indonesia No. 148 of 2015 concerning Implementation of Land Acquisition for Development for Public Interest.
3. Presidential Regulation of the Republic of Indonesia No. 62 of 2018 concerning Handling of Social Impacts in the Community in the Context of Providing Land for National Development

Ministerial Regulations and Decree

1. Minister of Environment Regulation No. 08 of 2006 on Guidelines for Environmental Impact Analysis
2. Minister of Manpower Regulation No. 33 of 2015 concerning Amendments to the Minister of Manpower Regulation No. 12 of 2015 concerning Safety and Health at Work Electricity in the Workplace
3. Regulation of the Minister of Life Protection and Forestry No.P.27 / Menlhk / Setjen / Kum.1 / 7/2018 concerning Guidelines for Borrowing and Using Forest Areas.
4. Regulation of the Minister of Manpower of the Republic of Indonesia Number 5 of 2018 concerning Occupational Safety and Health in the Work Environment
5. Regulation of the Minister of Energy and Mineral Resources No.27 of 2018 concerning Compensation for Land, Buildings and / or Plants Under Free Space of the Electric Power Transmission Network.
6. Regulation of the Minister of Environment and Forestry No.P.7 / Menlhk / Setjen / Kum.1 / 2/2019 concerning Amendments to the Regulation of the Minister of Life and Forestry Protection No.P.27 / Menlhk / Setjen / Kum.1 / 7/2018 About Borrowing and Use of Forest Areas Guidelines.
7. Regulation of the Minister of Energy and Mineral Resources No.2 of 2019 concerning Amendments to the Regulation of the Minister of Energy and Mineral Resources No.18 of 2015 concerning Free Space and Minimum Clearance in High-Voltage Airways, Extra-High-Voltage Airways and Airways High Voltage Direct Current For The Distribution of Electric Power.

8. Regulation of the Minister of Environment and Forestry of the Republic of Indonesia Number P.38 / MENLHK / SETJEN / KUM.1 / 7/2019 concerning Types of Business Plans and / or Activities that Require an Environmental Impact Analysis
9. Joint Decree of the Minister of Manpower and the Minister of Public Works of the Republic of Indonesia No. 174 of 1986 no. 104 / KPTS / 1986 concerning Occupational Safety and Health at Workplace Construction Section.
10. Minister of Mining and Energy Decree No. 103.K / MPE / 1994 concerning Guidelines for Environmental Management (RKL) and Environmental Monitoring (RPL) in the Mining and Energy Sector
11. Decree of the Minister of Mining and Energy No. 1899.K / MPE / 1994 concerning the Implementation of Electric Power Environmental Monitoring
12. Decree of the General Director of Energy and Electricity Development No. 7.12 / 008 / 600.2 / 1995, concerning Implementation Instructions for Supervision of Environmental Management and Monitoring of Electric Power
13. Decree of the Minister of Mines and Energy No. 1211.K / 008 / M.PE / 1995 concerning the Prevention and Overcoming of Environmental Destruction and Pollution in General Mining Business Activities.
14. Minister of Environment Decree No.48 of 1996 concerning Noise Level
15. Minister of Environment Decree No. KEP-299 / MENLH / 11/1996, concerning Technical Guidelines and Analysis of Social Aspects in the Preparation of Environmental Impact Analysis
16. Decree of the Minister of Mines and Energy No. 975.K / 47 / MPE / 99 concerning Regulations in Lieu of Decree of the Minister of Mines and Energy No.01.P / 47 / MPE / 92 concerning Free Space for High Voltage Transmission and Extra High Voltage Transmission.
17. Decree of the Minister of Energy and Mineral Resources No. 1457 K / 28 / MEM / 2000 concerning Technical Guidelines for Environmental Management in the Mining and Energy Sector.
18. Decree of the Minister of Environment No. 17 of 2001, concerning business and / or activity plans that require environmental impact analysis
19. Decree of the Minister of the Environment Number 86 of 2002 concerning Guidelines for Implementing Environmental Management Efforts and Environmental Monitoring Efforts
20. Minister of Forestry Decree No. P.14 / Menhut-II / 2006, concerning Guidelines for Borrowing and Using Forest Areas
21. Decree of the Minister of Energy and Mineral Resources No.143K / 20 / MEM / 2018 concerning the 2019-2038 National Electricity Plan.

Head of BAPEDAL Decree

1. Decree of the Head of BAPEDAL No. 056 of 1994 concerning Guidelines for the Determination of Significant Impacts.
2. Decree of the Head of BAPEDAL No. 299 BAPEDAL / 11/1996 concerning Technical Guidelines for Social Aspects a.) In Environmental Impact Analysis Studies.

3. Decree of the Head of BAPEDAL No. Kep.105 of 2007, concerning Guidelines for the Implementation of Environmental Management Plans (RKL) and Environmental Monitoring Plans (RPL)
4. Decree of the Head of BAPEDAL No. Kep-124/12/1997 regarding Guidelines for Public Health Aspects in Environmental Impact Analysis Studies.
5. Decree of the Head of BAPEDAL No. 08 of 2000 concerning Community Involvement in Environmental Impact Analysis Studies.
6. Decree of the Head of BAPEDAL No. 09/2000 on Guidelines for Environmental Impact Analysis

Local Regulations

1. West Java Provincial Regulation No. 2 of 2006 concerning Management of Protected Areas
2. West Java Provincial Regulation No. 22 of 2010 concerning the 2009-2029 West Java Provincial Spatial Plan.
3. West Java Provincial Regulation No. 01 of 2013 concerning Guidelines for Conservation and Control of the Use of Protected Areas
4. West Java Provincial Regulation No. 08/2014 on Forestry Implementation
5. West Java Governor Decree No. 39 of 2000 concerning Water Allocation and Water Quality Standards for the Citarum River and Its Tributaries in West Java
6. Regional Regulation of West Bandung Regency No.2 of 2012 concerning the Spatial Plan of West Bandung Regency in 2009 - 2029
7. Regional Regulation of West Bandung Regency Number 5 of 2012 concerning Protection and Management of the Regional Environment
8. Cianjur Regency Regional Regulation No. 17 of 2012 concerning the 2011-2031 Cianjur Regency Spatial Plan

Circular Letter

1. Circular Letter of the Minister of Environment No.31 / SE / MENKLH / 6/1987 concerning Procedures for Handling Environmental Damage and Pollution
2. Decree of the Director General of Industrial Relations and Labor Inspection No. 311 of 2002 concerning the Occupational Safety and Health Competency Certification of Electricians
3. Circular Letter of the Minister of Environment of the Republic of Indonesia No. B-14134 / MENLH / KP / 12/2003 Concerning Directives for Implementation of Article 1212 of Law Number 32 of 2009 concerning Environmental Protection and Management

APPENDIX D. ENVIRONMENTAL PERMIT

APPENDIX D. ENVIRONMENTAL PERMIT

A0003567

PEMERINTAH DAERAH PROVINSI JAWA BARAT
DINAS PENANAMAN MODAL DAN PELAYANAN TERPADU SATU PINTU
Jalan Sumatera Nomor 50 Telepon (022) 4237369 Faksimile (022) 4237081
Website: *www.dpmptsp.jabarprov.go.id* e-mail: *dpmptsp@jabarprov.go.id*
BANDUNG - 40115

KEPUTUSAN KEPALA DINAS PENANAMAN MODAL DAN PELAYANAN TERPADU SATU PINTU PEMERINTAH DAERAH PROVINSI JAWA BARAT

NOMOR 660/18/11.1.02.0/DPMPTSP/2018

TENTANG

IZIN LINGKUNGAN KEGIATAN PLTA UPPER CISOKAN PUMPED STORAGE KAPASITAS 4 x 260 MW DI KABUPATEN BANDUNG BARAT DAN KABUPATEN CIANJUR OLEH PT PLN (PERSERO) UNIT INDUK PEMBANGUNAN JAWA BAGIAN TENGAH I

KEPALA DINAS PENANAMAN MODAL DAN PELAYANAN TERPADU SATU PINTU PEMERINTAH DAERAH PROVINSI JAWA BARAT,

Menimbang : a. bahwa Kegiatan PLTA Upper Cisokan *Pumped Storage* Kapasitas 4 x 260 MW di Kabupaten Bandung Barat dan Kabupaten Cianjur oleh PT. PLN (Persero) Unit Induk Pembangunan Jawa Bagian Tengah I telah memiliki dokumen Penilaian Studi Andal, RKL/RPL yang mendapatkan persetujuan dari Gubernur Jawa Barat melalui surat Nomor : 660.1/1241-BPLHD tanggal 12 April 2007 perihal Penilaian Studi ANDAL, RKL-RPL Pembangunan PLTA Cisokan Hulu (*Pumped Storage*) di Kabupaten Bandung dan Kabupaten Cianjur, serta Surat Gubernur Jawa Barat Nomor 660/1985-BPLHD tanggal 21 April 2011 perihal Penilaian Studi Revisi ANDAL, RKL dan RPL PLTA *Upper* Cisokan *Pumped Storage* Kapasitas 4 x 260 MW (Rencana Kegiatan Pembangunan Jalan Hantar, Penambangan Quarry dan Pemanfaatan *Fly Ash* Batubara) di Kabupaten Bandung Barat dan Kabupaten Cianjur;

b. bahwa berdasarkan Pasal 73 Peraturan Pemerintah Nomor 27 Tahun 2012 tentang Izin Lingkungan, dinyatakan bahwa dokumen lingkungan yang telah mendapat persetujuan sebelum berlakunya Peraturan Pemerintah ini (23 Februari 2012) dinyatakan tetap berlaku dan dipersamakan sebagai Izin Lingkungan;

c. bahwa berdasarkan Peraturan Direksi PT. PLN (Persero) Nomor : 0013.P/Dir/2016 tentang Organisasi PT. PLN (Persero) Unit Induk Pembangunan Jawa Bagian Tengah I tanggal 21 Januari 2016, telah terjadi perubahan nama Pemrakarsa PLTA *Upper* Cisokan (*Pumped Storage)* Kapasitas 4 x 260 MW dari PT. PLN (Persero) Proyek Induk Pembangkitan dan Jaringan Jawa, Bali dan Nusa Tenggara kepada PT. PLN (Persero) Unit Induk Pembangunan Jawa Bagian Tengah I;

3. Pendokumentasian seluruh kegiatan pengelolaan lingkungan hidup yang dilakukan terkait dengan Kegiatan PLTA Upper Cisokan *Pumped Storage* Kapasitas 4 x 260 MW di Kabupaten Bandung Barat dan Kabupaten Cianjur.

KEENAM : Masa pemberlakuan Izin Lingkungan ini berlaku sama dengan masa berlaku izin usaha dan/atau kegiatan, sesuai ketentuan peraturan perundang-undangan.

KETUJUH : Pemegang Izin Lingkungan sebagaimana dimaksud pada Diktum KESATU, wajib mengajukan permohonan perubahan Izin Lingkungan apabila terjadi perubahan atas rencana usaha dan/atau kegiatannya sesuai dengan kriteria perubahan yang tercantum berdasarkan ketentuan peraturan perundang-undangan.

KEDELAPAN : Pemegang Izin Lingkungan sebagaimana dimaksud pada Diktum KESATU, menyampaikan laporan pelaksanaan kewajiban dan persyaratan sebagaimana dimaksud pada Diktum KEEMPAT dan Diktum KELIMA, setiap 6 (enam) bulan sekali kepada :

1. Menteri Lingkungan Hidup dan Kehutanan;
2. Gubernur Jawa Barat melalui Kepala Dinas Lingkungan Hidup Provinsi Jawa Barat;
3. Bupati Bandung Barat melalui Kepala Dinas Lingkungan Hidup Kabupaten Bandung Barat;
4. Bupati Cianjur melalui Kepala Dinas Lingkungan Hidup Kabupaten Cianjur;
5. Instansi lain yang terkait Kegiatan PLTA *Upper* Cisokan *Pumped Storage* Kapasitas 4 x 260 MW di Kabupaten Bandung Barat dan Kabupaten Cianjur.

KESEMBILAN : Apabila dalam pelaksanaan usaha dan/atau kegiatan, menimbulkan dampak di luar dampak lingkungan sebagaimana dimaksud pada Diktum KEEMPAT, Pemegang Izin Lingkungan wajib melaporkan kepada Instansi terkait, sebagaimana dimaksud pada Diktum KEDELAPAN.

KESEPULUH : Keputusan ini mulai berlaku pada tanggal ditetapkan.

Ditetapkan : Di Bandung
Pada Tanggal : 25 Mei 2018

PEMERINTAH DAERAH PROVINSI DINAS PMPTSP JAWA BARAT

KEPALA DINAS PENANAMAN MODAL DAN PELAYANAN TERPADU SATU PINTU,

Dr. Ir. H. DADANG MOHAMAD, M.SCE.
Pembina Utama Madya
NIP. 19601217 198511 1002

A 0007016

PEMERINTAH DAERAH PROVINSI JAWA BARAT

DINAS PENANAMAN MODAL DAN PELAYANAN TERPADU SATU PINTU

Jalan Sumatera Nomor 50 Telepon (022) 4237369 Faksimile (022) 4237081
Website: www.dpmptsp.jabarprov.go.id e-mail: dpmptsp@jabarprov.go.id
BANDUNG - 40115

KEPUTUSAN KEPALA DINAS PENANAMAN MODAL DAN PELAYANAN TERPADU SATU PINTU PEMERINTAH DAERAH PROVINSI JAWA BARAT

NOMOR 660/19/11.1.02.0/DPMPTSP/2018

TENTANG

IZIN LINGKUNGAN KEGIATAN PEMBANGUNAN SALURAN UDARA TEGANGAN EKSTRA TINGGI (SUTET) 500 KV PLTA CISOKAN HULU DI KABUPATEN BANDUNG BARAT DAN KABUPATEN CIANJUR OLEH PT PLN (PERSERO) UNIT INDUK PEMBANGUNAN JAWA BAGIAN TENGAH I

KEPALA DINAS PENANAMAN MODAL DAN PELAYANAN TERPADU SATU PINTU PEMERINTAH DAERAH PROVINSI JAWA BARAT,

Menimbang :

a. bahwa Kegiatan Pembangunan Saluran Udara Tegangan Ekstra Tinggi (SUTET) 500 KV PLTA Cisokan Hulu di Kabupaten Bandung Barat dan Kabupaten Cianjur oleh PT. PLN (Persero) Unit Induk Pembangunan Jawa Bagian Tengah I telah memiliki dokumen Penilaian Studi Andal, RKL/RPL yang mendapatkan persetujuan dari Gubernur Jawa Barat melalui surat Nomor : 660.1/1242-BPLHD tanggal 12 April 2007 perihal Penilaian Studi ANDAL, RKL-RPL Pembangunan SUTET 500 KV PLTA Cisokan Hulu di Kabupaten Bandung dan Kabupaten Cianjur, serta Surat Kepala Badan Pengendalian Lingkungan Hidup Daerah Pemerintah Provinsi Jawa Barat Nomor 660.1/45/I/2008 tanggal 4 Januari 2008 perihal Suplemen RKL dan RPL Pembangunan Jalur Tambahan SUTET 500 KV PLTA Cisokan Hulu di Kabupaten Bandung dan Kabupaten Cianjur;

b. bahwa berdasarkan Pasal 73 Peraturan Pemerintah Nomor 27 Tahun 2012 tentang Izin Lingkungan, dinyatakan bahwa dokumen lingkungan yang telah mendapat persetujuan sebelum berlakunya Peraturan Pemerintah ini (23 Februari 2012) dinyatakan tetap berlaku dan dipersamakan sebagai Izin Lingkungan;

c. bahwa berdasarkan Peraturan Direksi PT. PLN (Persero) Nomor : 0013.P/Dir/2016 tentang Organisasi PT. PLN (Persero) Unit Induk Pembangunan Jawa Bagian Tengah I tanggal 21 Januari 2016, telah terjadi perubahan nama Pemrakarsa Pembangunan Saluran Udara Tegangan Ekstra Tinggi (SUTET) 500 KV PLTA Cisokan Hulu di Kabupaten Bandung Barat dan Kabupaten Cianjur dari PT. PLN (Persero) Proyek Induk Pembangkit dan Jaringan Jawa, Bali, dan Nusa Tenggara Proyek Pembangkit dan Jaringan Jawa Barat kepada PT. PLN (Persero) Unit Induk Pembangunan Jawa Bagian Tengah I;

KEENAM	:	Masa pemberlakuan Izin Lingkungan ini berlaku sama dengan masa berlaku izin usaha dan/atau kegiatan, sesuai ketentuan peraturan perundang-undangan.
KETUJUH	:	Pemegang Izin Lingkungan sebagaimana dimaksud pada Diktum KESATU, wajib mengajukan permohonan perubahan Izin Lingkungan apabila terjadi perubahan atas rencana usaha dan/atau kegiatannya sesuai dengan kriteria perubahan yang tercantum berdasarkan ketentuan peraturan perundang-undangan.
KEDELAPAN	:	Pemegang Izin Lingkungan sebagaimana dimaksud pada Diktum KESATU, menyampaikan laporan pelaksanaan kewajiban dan persyaratan sebagaimana dimaksud pada Diktum KEEMPAT dan Diktum KELIMA, setiap 6 (enam) bulan sekali kepada : 1. Menteri Lingkungan Hidup dan Kehutanan; 2. Gubernur Jawa Barat melalui Kepala Dinas Lingkungan Hidup Provinsi Jawa Barat; 3. Bupati Bandung Barat melalui Kepala Dinas Lingkungan Hidup Kabupaten Bandung Barat; 4. Bupati Cianjur melalui Kepala Dinas Lingkungan Hidup Kabupaten Cianjur; 5. Instansi lain yang terkait Kegiatan Pembangunan SUTET 500 KV PLTA Cisokan Hulu di Kabupaten Bandung Barat dan Kabupaten Cianjur.
KESEMBILAN	:	Apabila dalam pelaksanaan usaha dan/atau kegiatan, menimbulkan dampak di luar dampak lingkungan sebagaimana dimaksud pada Diktum KEEMPAT, Pemegang Izin Lingkungan wajib melaporkan kepada Instansi terkait, sebagaimana dimaksud pada Diktum KEDELAPAN.
KESEPULUH	:	Keputusan ini mulai berlaku pada tanggal ditetapkan.

Ditetapkan : Di Bandung
Pada Tanggal : 06 Juni 2018

KEPALA DINAS PENANAMAN MODAL DAN PELAYANAN TERPADU SATU PINTU,

PEMERINTAH DAERAH PROVINSI DINAS PMPTSP JAWA BARAT

Dr. Ir. H. DADANG MOHAMAD, M.SCE.
Pembina Utama Madya
NIP. 19601217 198511 1002

APPENDIX E. ORGANIZATIONAL TEAM

APPENDIX E. ORGANIZATIONAL TEAM

No.	Name	Place, Date of Birth	ID. Number	Last Education	Position	Experience (Years)	Expertise
1	2	3	4	5	6	7	8
TA-1	Robi Andoyo	Bandung, 2 Maret 1978	3217010203780013	Phylosophy Doctor (PhD) in Agro-Industrial Technology	Team Leader: ESIA Expert	15 Years	*Expertise in* *Environmental and Social Management System (ESMS), Environmental Impact Analysis (ANDAL)*
TA-2	Dwi Rustam Kendarto	Sleman, 29 October 1969	3273182910690002	Doctoral in Agriculture Engineering	Hydrologist or Water Resources Specialist	25 Years	*Expertise in Soil Water Engineering, Water Resources and Spatial Information Technology*
TA-3	Gemilang L Utama	Bandung, 20 October 1984	3273092010840001	Doctoral in Environmental Science	Biodiversity Management Specialist	10 Years	*Expertise in Expertise in* *Environmental and Social Management System (ESMS), Environmental Impact Analysis (ANDAL) and Biodiversity Analysis*
TA-4	Indra Firmansyah	Merauke, 4 April 1983	3273220404830007	Master of Science (M.Sc.) in Environmental Management	Greenhouse Gas / Climate Change Specialist	13 Years	*Expertise in* *Environmental and Social Management System (ESMS), Environmental Impact Analysis (ANDAL), capacity building and Community Empowerment, Environmental and natural*

							management and monitoring, and baseline social / economic and environmental studies
TA-5	Dede A. Hasyir	Purwakarta, 16 August 1980	3273021608800004	Master of Accounting	Social Impact Assessment and Consultation Specialist	10 Years	*Expertise in Social Impact Analysis, Environmental and Social Governance, and Sustainability Reporting*
TA-6	Antik Bintari	Jakarta, 30 August 1975	3277037008750010	Master of Engineering, Bachelor in Political and Social Science	Gender Specialist	17 Years	*Expertise in gender-based research and activities*
TA-7	Sudaryat Permana	Bandung, 7 April 1971	3273270704710002	Doctoral in Law	Resource Management, Land or Conservation Legal Expert	20 Years	*Expertise in Handling in Land Acquisition, Mining, Corporate Action, Intellectual property and employment cases in court and outside the court*
TA-8	Indra Firmansyah	Merauke, 4 April 1983	3273220404830007	Master of Science (M.Sc.) in Environmental Management	Occupational Health and Safety Expert	13 Years	*Expertise in* *Environmental and Social Management System (ESMS), Environmental Impact Analysis (ANDAL), capacity building and Community Empowerment, Environmental and natural management and monitoring, and baseline social / economic and environmental studies.*

TA-9	Rizky Mulya Sampurno	Pati, 9 Maret 1989	3201140903890000	Master of Science	GIS Specialist	8 Years	*Expertise in Spatial Information Technology*
TP-1	Muhamad Akbar Anugrah	Bandung, 4 Mei 1992	3204374405920012	Bachelor (S1)	Assistant of Labour Management	4 Years	*Experience on Labour Management*
TP-2	Musfiq Amrullah	Cirebon, 14 October 1992	3209351410920001	Bachelor (S1)	Assistant of Cultural Heritage	4 Years	*Experience on Cultural Heritage and Chance Find Procedue*
TP-3	Yulinda Silviana	31 Maret 1992	3204057103920001	Bachelor(S1)	Bi-lingual secretary	5 Years	*Experience on Communication and Secretarial activities*
TP-4	Rahmi Rahmawati	Sumedang, 18 Mei 1989	3211155805880006	Bachelor (S1)	Computer Operator	4 Years	*Experience as computer operator*

APPENDIX F. SPECIES LISTS

Table A1. List of plants found in UCPS

No.	FamilyFamili	Nama IlmiahScientific name	Local nameNama Daerah	Kategori					Permen	CITES	IUCN	Lokasi										
				Po	Ti	Pc	Sm	Tb				13	14	15	16	17	18	19	20	21	22	23
1	Achariaceae	*Pangium edule* Reinw. ex Blume	Picung	+					–	–	–								√			
2	Actinidiaceae	*Saurauia pendula* Blume.	Kileho		+				–	–	LC			√			√	√	√	√		√
3	Altingiaceae	*Altingia excelsa* Noronha	Rasamala		+				–	–	LC	√	√	√	√	√	√	√	√	√	√	√
4	Amarantaceae	*Achyranthes aspera* Linn.	Jarong					+	–	–	–	√	√	√	√	√	√	√	√	√	√	√
5	Amarantaceae	*Amaranthus caudatus* L.	Bayam Liar					+	–	–	–	√	√					√	√	√	√	√
6	Anacardiaceae	*Mangifera odorata* Griff.	Limus		+				–	–	DD	√	√		√	√	√	√	√		√	
7	Anacardiaceae	*Mangifera indica* L.	Mangga	+		+			–	–	DD	√	√					√			√	
8	Annonaceae	*Annona squamosa* L.	Nona Belanda	+					–	–	–							√				
9	Annonaceae	*Annona muricata* L.	Sirsak		+				–	–	–			√			√	√				
10	Apocynaceae	*Alstonia scholaris* (L.) R. Br.	Lame		+	+			–	–	LC			√				√	√	√		√
11	Apocynaceae	*Catharanthus roseus* (L.) G.Don	Tapak Dara					+	–	–	–			√				√	√			
12	Aracaeae	*Alocasia macrorrhizos* (L.) G.Don	Sente					+	–	–	–	√	√	√	√	√	√	√	√	√	√	√
13	Araceae	*Colocasia esculenta* L.	Talas					+	–	–	–	√	√	√	√	√	√	√			√	
14	Araceae	*Caladium bicolor* (Aiton) Vent.	Keladi					+	–	–	–			√					√			
15	Araceae	*Anthurium andraeanum* Linden ex André	Gelombang cinta					+	–	–	–			√				√				
16	Araliaceae	*Macropanax dispermus* (Blume) Kuntze	Cerem			+			–	–	LC			√				√	√	√		√
17	Araliaceae	*Schefflera lucida* (Blume) Frodin	Ramo giling			+			–	–	–			√					√			
18	Arecaceae	*Areca catechu* L.	Pinang		+				–	–	–			√				√				
19	Arecaceae	*Cocos nucifera* L.	Kelapa		+				–	–	–		√	√				√				
20	Arecaceae	*Wodyetia bifurcata* A.K.Irvine	Palem ekor tupai		+				–	–	DD			√						√		√
21	Arecaceae	*Rhapis excelsa* L.f. ex Aiton	Waregu				+		–	–	–			√				√		√		√
22	Arecaceae	*Arenga pinnata* (Wurmb) Merr.	Aren	+					–	–	–	√	√	√	√	√	√		√		√	
23	Arecaceae	*Plectocomia elongata* Mart. ex Blume	Bubuay			+			–	–	–			√					√			

No.	FamilyFamili	Nama IlmiahScientific name	Local nameNama Daerah	Kategori					Permen	CITES	IUCN	Lokasi										
				Po	Ti	Pc	Sm	Tb				13	14	15	16	17	18	19	20	21	22	23
24	Asteraceae	*Ageratum conyzoides L.*	Babadotan					+	–	–	–	√	√	√	√	√	√		√	√	√	√
25	Asteraceae	*Clibadium surinamense* L.	Katepos			+	+		–	–	–			√	√	√	√			√		√
26	Asteraceae	*Austroeupatorium inulifolium* (Kunth) R.M. King & H.Rob.	Kirinyuh			+	+		–	–	–	√	√		√	√	√		√		√	
27	Asteraceae	*Bidens pilosa* L.	Harega					+	–	–	–	√	√	√	√	√	√		√	√	√	√
28	Asteraceae	*Chrysanthemum x grandiflorum* L.	Serunai					+	–	–	–							√	√	√		√
29	Asteraceae	*Acmella paniculata* (Wall. ex DC.) R.K.Jansen	Rumput Jotang					+	–	–	–	√	√		√	√	√		√	√	√	√
30	Asteraceae	*Blumea balsamifera* L.	Daun sembung					+	–	–	–		√		√	√	√			√		√
31	Asteraceae	*Tithonia diversifolia* (Hemsl.) A.Gray	Kipait					+	–	–	–	√	√		√	√	√	√	√	√	√	√
32	Asteraceae	*Crassocephalum crepidioides* (Benth.) S.Moore	Sintrong					+	–	–	–	√	√		√	√	√	√	√		√	
33	Asteraceae	*Emilia sonchifolia* (L.) DC. Ex Wight	Tespog					+	–	–	–	√	√	√	√	√	√	√	√	√	√	√
34	Asteraceae	*Porophyllum ruderale* (Jacq.) Cass.	Seungit mangga ngora					+	–	–	–	√	√	√						√	√	√
35	Asteraceae	*Elephantopus scaber* L.	Tapak liman					+	–	–	–	√	√	√		√	√		√		√	
36	Balsaminaceae	*Impatiens balsamina* L.	Pacar air					+	–	–	–	√	√		√	√	√	√	√	√	√	√
37	Basellaceae	*Anredera cordifolia* (Ten.) Steenis	Binahong					+	–	–	–			√				√				
38	Begoniaceae	*Begonia isoptera* Dryand. ex Sm.	Hariang bodas					+	–	–	–	√		√					√	√	√	√
39	Bignoniaceae	*Spathodea campanulata* P.Beauv.	Kiacret	+					–	–	–		√		√	√	√	√	√	√		√
40	Bromeliaceae	*Ananas comosus* (L.) Merr.	Nanas				+		–	–	–							√		√		√
41	Cannabaceae	*Trema orientalis* (L.) Blume	Kuray	+	+	+			–	–	LC	√	√	√	√	√	√	√	√		√	
42	Caricaceae	*Carica papaya* L.	Pepaya			+			–	–	–		√	√	√	√	√	√		√		√
43	Convolvulaceae	*Ipomoea aquatica* Forssk.	Kangkung					+	–	–	–			√				√				
44	Costaceae	*Cheilocostus speciosus* (J.König) C.Specht	Pacing				+		–	–	LC		√				√	√	√			
45	Cucurbitaceae	*Cucurbita argyrosperma* L.	Labu besar					+	–	–	–			√				√				
46	Elaeocarpaceae	*Sloanea sigun* (Blume) K. Schum.	Tebe		+	+			–	–	–			√					√			
47	Euphorbiaceae	*Hevea brasiliensis* (Willd. ex A.Juss.) Müll.Arg.	Karet		+				–	–	–							√				
48	Euphorbiaceae	*Euphorbia milii* Desmoul.	Euphorbia					+	–	–	DD									√		√
49	Euphorbiaceae	*Euphorbia pulcherrima* Willd. ex Klotzsch	Kastuba				+		–	–	–			√				√		√		√
50	Euphorbiaceae	*Aleurites moluccana* (L.) Willd	Kemiri	+	+	+			–	–	–		√	√				√		√		√

No.	FamilyFamili	Nama IlmiahScientific name	Local nameNama Daerah	Kategori					Permen	CITES	IUCN	Lokasi										
				Po	Ti	Pc	Sm	Tb				13	14	15	16	17	18	19	20	21	22	23
51	Euphorbiaceae	*Manihot esculenta* Crantz.	Singkong				+		–	–	–		√	√	√	√	√	√		√		√
52	Euphorbiaceae	*Macaranga tanarius* (L.) Müll.Arg.	Mara		+	+			–	–	–		√	√	√	√	√		√	√		√
53	Euphorbiaceae	*Macaranga triloba* (Blume) Mull. Arg.	Mara			+	+		–	–		√	√	√	√	√	√	√	√		√	
54	Fabaceae	*Falcataria moluccana* (Miq.) Barneby & J.W.Grimes	Albasiah	+	+	+			–	–	–		√	√	√	√	√	√	√			
55	Fabaceae	*Calliandra calothyrsus* Meisn.	Kaliandra			+			–	–	–	√	√	√	√	√	√	√	√		√	
56	Fabaceae	*Erythrina variegata* L.	Dadap		+				–	–	–							√				
57	Fabaceae	*Erythrina microcarpa* Koord. & Valeton	Dadap Cangkring	+	+				–	–	–							√		√		√
58	Fabaceae	*Cassia siamea* Lamk	Johar	+	+	+			–	–	–			√						√		√
59	Fabaceae	*Parkia speciosa* Hassk.	Petai	+	+				–	–	–		√		√	√	√		√	√		√
60	Fabaceae	*Mimosa pigra* L.	Rumput garuk			+			–	–	–		√	√				√	√	√		√
61	Fabaceae	*Clitoria ternatea* L.	Kembang Telang					+	–	–	–		√		√	√	√	√	√			
62	Fabaceae	*Leucaena leucocephala* (Lamk.) de Wit	Petai cina		+	+			–	–	–		√		√	√	√	√	√			
63	Fabaceae	*Arachis hypogaea* L.	Kacang tanah					+	–	–	–				√	√	√					
64	Fabaceae	*Tamarindus indica* L.	Asam jawa	+					–	–	LC							√				
65	Fabaceae	*Glycine max* subsp. *soja* (Siebold & Zucc.) H.Ohashi	Soya					+	–	–	–							√				
66	Fabaceae	*Acacia mangium* Willd.	Akasia	+	+				–	–	LC							√		√		√
67	Fabaceae	*Gliricidia sepium* (Jacq.) Kunth ex Walp.	Gamal			+			–	–	LC		√		√	√	√	√				
68	Fabaceae	*Albizia saman* (Jacq.) Merr.	Trembesi		+	+			–	–	–							√				
69	Fabaceae	*Phaseolus lunatus* L.	Kacang roway/kratok				+		–	–	–							√		√		√
70	Fabaceae	*Pterocarpus indicus* Willd.	Angsana		+	+			–	–	VUEN**							√		√		√
71	Fabaceae	*Archidendron pauciflorum* (Benth.) I.C.Nielsen	Jengkol		+	+			–	–	–		√		√	√	√	√	√			
72	Hypoxidaceae	*Molineria capitulata* (Lour.) Herb.	Congkok					+	–	–	–	√	√		√	√	√	√	√	√	√	√
73	Lamiaceae	*Hyptis capitata* Jacq.	Bobotolan				+		–	–	–				√	√	√	√				
74	Lamiaceae	*Tectona grandis* Linn.f.	Jati	+		+			–	–	–		√		√	√	√	√	√	√		√
75	Lamiaceae	*Lavandula angustifolia* L.	Lavender				+		–	–	–							√				
76	Lamiaceae	*Gmelina arborea* Roxb.	Jati putih	+	+				–	–	LC		√		√	√	√	√				
77	Lamiaceae	*Ocimum* x *africanum* Lour.	Sarung Langit					+	–	–	–									√		√

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				Po	Ti	Pc	Sm	Tb				13	14	15	16	17	18	19	20	21	22	23
78	Lauraceae	*Cinnamomum verum* J.Presl	Kayu manis		+	+			–	–	–							√	√			
79	Lauraceae	*Persea americana* Mill.	Alpukat		+	+	+		–	–	LC	√	√		√	√	√	√	√		√	
80	Laxmanniaceae	*Cordyline fruticosa* Comm. ex R.Br.	Hanjuang				+		–	–	–							√	√	√		√
81	Magnoliaceae	*Magnolia lanuginosa* (Wall.) Figlar & Noot.	Manglid			+			–	–	DD	√						√	√	√	√	√
82	Malvaceae	*Durio zibethinus* Rumph. ex Murray	Durian	+		+			–	–	–		√			√			√			
83	Malvaceae	*Hibiscus macrophyllus* Roxb.	Tisuk	+			+		–	–	–	√	√		√	√	√	√	√	√	√	√
84	Malvaceae	*Ceiba pentandra* (L). Gaertn.	Randu	+					–	–	–		√					√	√	√		√
85	Malvaceae	*Theobroma cacao* L	Cokelat			+			–	–	–								√	√		√
86	Melastomataceae	*Clidemia hirta* (L.) D. Don	Harendong bulu					+	–	–	–	√	√		√	√	√		√		√	
87	Melastomataceae	*Melastoma malabathricum* L.	Harendong			+		+	–	–	–	√	√		√	√	√		√	√	√	√
88	Meliaceae	*Swietenia macrophylla* King.	Mahoni		+	+			–	–	VU*								√			
89	Meliaceae	*Swietenia mahagoni* (L.) Jacq.	Mahoni	+					–	–	NT*		√									
90	Meliaceae	*Dysoxylum parasiticum* (Osbeck) Kosterm.	Pisitan Monyet		+				–	–	–								√	√		√
91	Meliaceae	*Melia azedarach* L	Mindi		+	+			–	–	LC				√	√	√		√			
92	Meliaceae	*Toona sureni* (Blume) Merr.	Suren	+	+	+			–	–	LC	√	√		√	√	√	√	√		√	
93	Moraceae	*Morus alba* L.	Murbei			+			–	–	–							√				
94	Moraceae	*Ficus elastica* Roxb.	Karet Kebo	+					–	–	–							√		√		√
95	Moraceae	*Artocarpus camansi* Blanco	Keluwih		+				–	–	–							√				
96	Moraceae	*Artocarpus heterophyllus* Lam.	Nangka		+	+			–	–	–		√		√	√	√		√	√		√
97	Moraceae	*Ficus benjamina* L.	Beringin	+					–	–	LC				√	√	√	√	√			
98	Moraceae	*Artocarpus altilis* (Parkinson ex F.A.Zorn) Fosberg	Sukun		+	+			–	–	–	√	√		√	√	√	√		√	√	√
99	Moraceae	*Ficus septica* Burm.f.	Kiciyat			+	+		–	–	LC		√	√	√			√	√	√		√
100	Moraceae	*Ficus fistulosa* Reinw. ex Blume	Beunying		+	+			–	–	LC							√				
101	Moraceae	*Ficus padana* Burm.f.	Hamerang	+	+				–	–	LC	√	√	√		√	√	√	√		√	
102	Moraceae	*Ficus variegata* Blume	Kondang	+					–	–	LC								√	√		√
103	Moraceae	*Artocarpus elasticus* Reinw. ex Blume	Teureup	+	+	+			–	–	LC			√					√			
104	Moraceae	*Ficus racemosa* L.	Loa			+			–	–	LC								√			

No.	FamilyFamili	Nama IlmiahScientific name	Local nameNama Daerah	Kategori					Permen	CITES	IUCN	Lokasi										
				Po	Ti	Pc	Sm	Tb				13	14	15	16	17	18	19	20	21	22	23
105	Muntingiaceae	*Muntingia calabura* L.	Kersen			+	+		–	–	–							√	√	√		√
106	Musaceae	*Musa × paradisiaca* L.	Pisang			+			–	–	–	√	√		√	√	√	√	√	√	√	√
107	Myrtaceae	*Syzygium aqueum* Brm.F	Jambu air	+	+	+			–	–	–		√					√	√	√		√
108	Myrtaceae	*Psidium guajava* L.	Jambu batu		+		+		–	–	–		√					√		√		√
109	Myrtaceae	*Syzygium aromaticum* L.	Cengkeh		+	+			–	–	–		√					√	√			
110	Myrtaceae	*Syzygium malaccense* L.	Jambu bol	+	+	+			–	–	–		√					√				
111	Myrtaceae	*Syzygium oleosum* (F.Muell.) B.Hyland	Pucuk merah		+		+		–	–	–							√				
112	Myrtaceae	*Syzygium nervosum* A.Cunn. ex DC.	Kopo	+	+				–	–	LC								√			
113	Oxalidaceae	*Averrhoa carambola* L.	Belimbing						–	–	–							√				
114	Pandanaceae	*Pandanus amaryllifolius* Roxb.	Pandan wangi				+	+	–	–	–							√				
115	Phyllantaceae	*Phyllanthus acidus* L.	Ceremai		+				–	–	–									√		√
116	Phyllantaceae	*Cleistanthus monoicus* (Lour.) Müll.Arg.	Kanyere			+			–	–	–									√		√
117	Pinaceae	*Pinus merkusii* Jungh. & de Vriese	Pinus	+	+	+			–	–	VU*	√	√	√	√	√	√		√	√	√	√
118	Piperaceae	*Piper aduncum* L.	Kiseureuh			+			–	–	–	√	√	√	√	√	√		√		√	
119	Plantaginaceae	*Plantago major* L.	Ki urat					+	–	–		√	√	√							√	
120	Poaceae	*Axonopus compressus* (Sw.) P.Beauv.	Jukut Pait					+	–	–	–	√	√	√					√	√	√	√
121	Poaceae	*Saccharum officinarum* L.	Tebu				+		–	–	–								√	√		√
122	Poaceae	*Pennisetum purpureum* Schumach.	Rumput gajah					+	–	–	–	√	√	√	√	√	√	√	√	√	√	√
123	Poaceae	*Cyperus rotundus* L.	Rumput Teki					+	–	–			√						√			
124	Poaceae	*Imperata cylindrica* (L.)	Alang-alang					+	–	–	–	√	√	√	√	√	√	√	√		√	
125	Poaceae	*Zea mays* ssp. *Mays* (L.)	Jagung					+	–	–	–				√	√	√	√	√	√		√
126	Poaceae	*Saccharum spontaneum* L.	Kaso					+	–	–	–							√	√	√		√
127	Poaceae	*Bambusa vulgaris* var. *striata*	Bambu haur hijau					+	–	–	–		√					√	√	√		√
128	Poaceae	*Gigantochloa apus* (Schult. & Schult.f.)	Bambu tali					+	–	–	–	√	√	√	√	√	√		√		√	
129	Poaceae	*Oryza sativa* L.	Padi					+	–	–	–		√		√	√	√		√	√		√
130	Poaceae	*Coix lacryma-jobi* L.	Hanjeli					+	–	–	–									√		√
131	Rhamnaceae	*Maesopsis eminii* Engl.	Sobsi	+	+	+			–	–	–	√	√	√	√	√	√		√	√	√	√

No.	FamilyFamili	Nama IlmiahScientific name	Local nameNama Daerah	Kategori					Permen	CITES	IUCN	Lokasi										
				Po	Ti	Pc	Sm	Tb				13	14	15	16	17	18	19	20	21	22	23
132	Rubiaceae	*Neolamarckia cadamba* (Roxb.) Bosser	Jabon		+				–	–	–		√						√			
133	Rubiaceae	*Coffea canephora* Pierre ex A.Froehner	Kopi			+			–	–	LC	√	√	√	√	√	√		√		√	
134	Rutaceae	*Citrus maxima* (Burm.) Merr.	Jeruk bali				+		–	–	–							√				
135	Rutaceae	*Citrus* × *hystrix* L.	Jeruk purut				+		–	–	–							√				
136	Sapindaceae	*Dimocarpus longan* Lour.	Lengkeng		+	+			–	–	NT*									√		√
137	Sapindaceae	*Nephelium lappaceum* L.	Rambutan	+		+			–	–	LC							√		√		√
138	Sapotaceae	*Chrysophyllum cainito* L.	Sawo duren		+	+			–	–	–		√									
139	Selaginellaceae	*Selaginella plana* (Desv. ex Poir.) Hieron.	Rane					+	–	–	–	√	√	√	√	√	√	√			√	
140	Solanaceae	*Solanum pseudocapsicum* var. *diflorum* (Vell.) Bitter	Cabe Hias				+		–	–	–									√		√
141	Solanaceae	*Solanum torvum* Sw.	Takokak					+	–	–	–	√	√	√	√	√	√	√		√	√	√
142	Urticaceae	*Oreocnide rubescens* (Blume) Miq.	Nangsi				+		–	–	LC	√		√				√	√		√	
143	Verbenaceae	*Lantana camara* L.	Saliara				+	+	–	–	–	√	√	√	√	√	√	√		√	√	√
144	Zingiberaceae	*Etlingera elatior* (Jack) R.M.Sm.	Honje					+	–	–	DD			√					√			
145	Zingiberaceae	*Etlingera coccinea* (Blume) S.Sakai & Nagam.	Tepus					+	–	–	LC	√	√	√	√	√	√	√	√	√	√	√
	51 Famili										VU = 3	46	74	58	58	60	62	92	84	72	46	72

Sumber : Data Primer, 2020

Keterangan:

Kategori Po : PohonTree, Ti : Tiang, Pc : Pancang, Sm : Semai, Tb : Tumbuhan bawah

* bukan jenis alaminon-native species (tanaman yang sengaja ditanamplanted species for forestry or re-forestation) sebagai tanaman kehutanan atau penghijauan

** IUCN RedList considers this species Endangered and native to Java

Status Konservasi:

- Peraturan Menteri Lingkungan Hidup dan Kehutanan Republik Indonesia Nomor P.106/MENLHK/SETJEN/KUM.1/6/2018 Tentang Perubahan Kedua atas Peraturan Menteri Lingkungan Hidup dan Kehutanan Nomor P.20/MENLHK/SETJEN/KUM.1/6/2018 Tentang Jenis Tumbuhan dan Satwa yang Dilindungi.
- Status Konservasi dunia - IUCN (*International Union of Conservation of Nature*): NT: near threatened; EN: Endangered ; VU: Vulnerable ; LC: Least Concern, DD: Data Deficient
- Status perdagangan jenis terancam - CITES (*Convention on International Trade in Endangered Species*); Status I = Appendix I; Status II = Appendix II; Status III = Appendix III

Table A2. List of Vegetation in Transmission Line

No.	Famili	Nama Ilmiah	Nama Daerah	Kategori					Permen	CITES	IUCN	Lokasi											
				Po	Ti	Pc	Sm	Tb				1	2	3	4	5	6	7	8	9	10	11	12
1	Achariaceae	*Pangium edule*	Picung	+					–	–	–										√		√
2	Actinidiaceae	*Saurauia pendula*	Kileho		+				–	–	LC	√										√	√
3	Altingiaceae	*Altingia excelsa*	Rasamala		+				–	–	LC	√	√								√	√	√
4	Amarantaceae	*Achyranthes aspera*	Jarong					+	–	–	–	√	√	√	√	√	√	√	√	√	√	√	√
5	Amarantaceae	*Amaranthus caudatus* L.	Bayam Liar					+	–	–	–		√	√	√	√	√	√	√	√	√		
6	Anacardiaceae	*Mangifera odorata* Griff.	Limus		+				–	–	DD	√	√	√	√	√	√	√	√	√	√		√
7	Anacardiaceae	*Mangifera indica* L.	Mangga	+		+			–	–	DD	√	√	√	√	√	√	√	√	√		√	√
8	Annonaceae	*Annona muricata* L.	Sirsak		+				–	–	–			√	√								
9	Araceae	*Alocasia macrorrhizos*	Sente					+	–	–	–	√	√	√	√	√	√	√	√	√	√	√	√
10	Araceae	*Colocasia esculenta* L.	Talas					+	–	–	–	√	√	√	√	√	√	√	√	√	√	√	√
11	Araceae	*Caladium bicolor*	Keladi					+	–	–	–				√								
12	Araliaceae	*Macropanax dispermus*	Cerem			+			–	–	LC												√
13	Araliaceae	*Schefflera lucida*	Ramo giling			+			–	–	–	√											√
14	Arecaceae	*Areca catechu* L.	Pinang		+				–	–	–		√		√						√		
15	Arecaceae	*Cocos nucifera* L.	Kelapa		+				–	–	–		√	√	√	√	√	√	√	√			
16	Arecaceae	*Arenga pinnata*	Aren	+					–	–	–	√	√	√	√	√					√	√	√
17	Arecaceae	*Plectocomia elongata*	Bubuay			+			–	–	–	√											√
18	Asteraceae	*Ageratum conyzoides L.*	Babadotan					+	–	–	–	√	√	√	√	√	√	√	√	√	√	√	√
19	Asteraceae	*Clibadium surinamense* L.	Katepos			+	+		–	–	–				√	√	√	√	√	√			
20	Asteraceae	*Austroeupatorium inulifolium*	Kirinyuh			+	+		–	–	–	√	√	√	√	√	√	√	√	√	√	√	√
21	Asteraceae	*Bidens pilosa* L.	Harega					+	–	–	–	√	√		√	√	√	√	√	√	√	√	√
22	Asteraceae	*Chrysanthemum x grandiflorum*	Serunai					+	–	–	–	√	√	√	√	√	√	√	√	√	√	√	√
23	Asteraceae	*Acmella paniculata*	Rumput Jotang					+	–	–	–	√	√	√	√						√	√	√
24	Asteraceae	*Blumea balsamifera* L.	Daun sembung					+	–	–	–	√		√	√						√	√	√
25	Asteraceae	*Tithonia diversifolia*	Kipait					+	–	–	–	√	√	√	√	√	√	√	√	√	√	√	√

No.	Famili	Nama Ilmiah	Nama Daerah	Kategori					Permen	CITES	IUCN	Lokasi											
				Po	Ti	Pc	Sm	Tb				1	2	3	4	5	6	7	8	9	10	11	12
26	Asteraceae	*Crassocephalum crepidioides*	Sintrong					+	–	–	–		√		√						√	√	√
27	Asteraceae	*Emilia sonchifolia*	Tespog					+	–	–	–	√	√	√	√	√	√	√	√	√	√	√	√
28	Asteraceae	*Porophyllum ruderale*	Seungit mangga ngora					+	–	–	–		√	√	√	√	√	√	√	√		√	√
29	Asteraceae	*Elephantopus scaber* L.	Tapak liman					+	–	–	–		√	√	√	√	√	√	√	√			√
30	Balsaminaceae	*Impatiens balsamina* L.	Pacar air					+	–	–	–	√	√					√			√	√	√
31	Begoniaceae	*Begonia isoptera*	Hariang bodas					+	–	–	–											√	√
32	Bignoniaceae	*Spathodea campanulata*	Kiacret	+					–	–	–			√	√	√					√		√
33	Bromeliaceae	*Ananas comosus* (L.) Merr.	Nanas				+		–	–	–		√	√	√	√					√	√	
34	Cannabaceae	*Ananas comosus* (L.) Merr.	Kuray	+	+	+			–	–	LC	√									√	√	√
35	Caricaceae	*Carica papaya* L.	Pepaya			+			–	–	–	√	√	√	√	√	√	√	√	√	√	√	√
36	Convolvulaceae	*Ipomoea aquatica* Forssk.	Kangkung					+	–	–	–		√										
37	Costaceae	*Cheilocostus speciosus*	Pacing				+		–	–	LC	√	√	√	√						√	√	√
38	Cucurbitaceae	*Cucurbita argyrosperma* L.	Labu besar					+	–	–	–											√	
39	Elaeocarpaceae	*Sloanea sigun*	Tebe		+	+			–	–	–	√											√
40	Euphorbiaceae	*Codiaeum variegatum* L.	Puring				+		–	–	–					√	√	√	√	√			
41	Euphorbiaceae	*Hevea brasiliensis*	Karet		+				–	–	–			√	√	√					√	√	√
42	Euphorbiaceae	*Aleurites moluccana*	Kemiri	+	+	+			–	–	–			√	√							√	
43	Euphorbiaceae	*Manihot esculenta* Crantz.	Singkong				+		–	–	–	√	√	√	√	√	√	√	√	√	√	√	√
44	Euphorbiaceae	*Macaranga tanarius*	Mara		+	+			–	–	–	√	√		√						√	√	√
45	Euphorbiaceae	*Macaranga triloba*	Mara			+	+		–	–		√	√		√						√	√	√
46	Fabaceae	*Falcataria moluccana*	Albasiah	+	+	+			–	–	–	√	√	√	√	√					√	√	√
47	Fabaceae	*Calliandra calothyrsus* Meisn.	Kaliandra			+			–	–	–	√	√	√	√	√					√	√	√
48	Fabaceae	*Cassia siamea* Lamk	Johar	+	+	+			–	–	–				√								√
49	Fabaceae	*Parkia speciosa* Hassk.	Petai	+	+				–	–	–		√		√	√					√	√	
50	Fabaceae	*Mimosa pigra* L.	Rumput garuk			+			–	–	–	√	√		√	√						√	√
51	Fabaceae	*Clitoria ternatea* L.	Kembang Telang					+	–	–	–			√	√	√					√	√	√
52	Fabaceae	*Leucaena leucocephala*	Petai cina		+	+			–	–	–	√			√	√					√	√	√

No.	Famili	Nama Ilmiah	Nama Daerah	Kategori					Permen	CITES	IUCN	Lokasi											
				Po	Ti	Pc	Sm	Tb				1	2	3	4	5	6	7	8	9	10	11	12
53	Fabaceae	*Tamarindus indica* L.	Asam jawa	+					–	–	LC				√	√							
54	Fabaceae	*Acacia mangium* Willd.	Akasia	+	+				–	–	LC				√	√							√
55	Fabaceae	*Gliricidia sepium*	Gamal			+			–	–	LC	√	√		√							√	
56	Fabaceae	*Albizia saman* (Jacq.) Merr.	Trembesi		+	+			–	–	–				√								
57	Fabaceae	*Phaseolus lunatus* L.	Kacang roway/kratok				+		–	–	–											√	
58	Fabaceae	*Archidendron pauciflorum*	Jengkol		+	+			–	–	–	√	√	√	√	√					√	√	√
59	Fabaceae	*Adenanthera pavonia* L.	Saga pohon	+	+				–	–		√		√	√		√						
60	Fagaceae	*Castanopsis javanica* Blume	Saninten		+				–	–	LC	√											
61	Hypoxidaceae	*Molineria capitulata*	Congkok					+	–	–	–	√	√	√	√						√	√	√
62	Lamiaceae	*Hyptis capitata* Jacq.	Bobotolan				+		–	–	–	√	√	√	√	√					√	√	√
63	Lamiaceae	*Tectona grandis* Linn.f.	Jati	+		+			–	–	–	√	√	√	√	√					√	√	√
64	Lamiaceae	*Gmelina arborea* Roxb.	Jati putih	+	+				–	–	LC	√	√	√	√	√					√	√	√
65	Lauraceae	*Cinnamomum verum* J.Presl	Kayu manis		+	+			–	–	–	√											√
66	Lauraceae	*Persea americana* Mill.	Alpukat		+	+	+		–	–	LC	√	√		√								√
67	Laxmanniaceae	*Cordyline fruticosa*	Hanjuang				+		–	–	–				√	√							
68	Malvaceae	*Durio zibethinus*	Durian	+		+			–	–	–	√	√	√	√						√	√	√
69	Malvaceae	*Hibiscus macrophyllus* Roxb.	Tisuk	+			+		–	–	–	√	√	√	√	√					√	√	√
70	Malvaceae	*Ceiba pentandra* (L). Gaertn.	Randu	+					–	–	–		√	√	√								√
71	Malvaceae	*Microcos tomentosa* Sm.	Jeluak	+					–	–	LC		√		√								√
72	Melastomataceae	*Clidemia hirta* (L.) D. Don	Harendong bulu					+	–	–	–	√	√	√	√	√					√	√	√
73	Melastomataceae	*Melastoma malabathricum* L.	Harendong			+		+	–	–	–	√	√	√	√	√					√	√	√
74	Meliaceae	*Swietenia macrophylla* King.	Mahoni		+	+			–	–	VU	√	√	√	√						√	√	√
75	Meliaceae	*Swietenia mahagoni*	Mahoni	+					–	–	NT*	√	√	√	√	√					√	√	√
76	Meliaceae	*Dysoxylum parasiticum*	Pisitan Monyet		+				–	–	–				√								
77	Meliaceae	*Melia azedarach* L	Mindi		+	+			–	–	LC	√	√		√							√	
78	Meliaceae	*Toona sureni* (Blume) Merr.	Suren	+	+	+			–	–	LC	√	√	√	√	√						√	√
79	Moraceae	*Artocarpus heterophyllus*	Nangka		+	+			–	–	–	√	√	√		√					√	√	√

No.	Famili	Nama Ilmiah	Nama Daerah	Kategori					Permen	CITES	IUCN	Lokasi											
				Po	Ti	Pc	Sm	Tb				1	2	3	4	5	6	7	8	9	10	11	12
80	Moraceae	*Ficus benjamina* L.	Beringin	+					–	–	LC	√	√		√								√
81	Moraceae	*Artocarpus altilis*	Sukun		+	+			–	–	–	√	√	√	√	√					√	√	√
82	Moraceae	*Ficus septica* Burm.f.	Kiciyat			+	+		–	–	LC	√	√	√	√	√					√	√	√
83	Moraceae	*Ficus fistulosa*	Beunying		+	+			–	–	LC											√	√
84	Moraceae	*Ficus padana* Burm.f.	Hamerang	+	+				–	–	LC	√			√						√	√	√
85	Moraceae	*Ficus variegata* Blume	Kondang	+					–	–	LC				√								√
86	Moraceae	*Artocarpus elasticus*	Teureup	+	+	+			–	–	LC	√			√							√	√
87	Muntingiaceae	*Muntingia calabura* L.	Kersen			+	+		–	–	–				√	√							
88	Musaceae	*Musa × paradisiaca* L.	Pisang			+			–	–	–	√	√	√	√	√	√			√	√	√	√
89	Myrtaceae	*Syzygium aqueum* Brm.F	Jambu air	+	+	+			–	–	–		√	√	√						√		
90	Myrtaceae	*Psidium guajava* L.	Jambu batu		+		+		–	–	–	√	√	√		√							
91	Myrtaceae	*Syzygium aromaticum* L.	Cengkeh		+	+			–	–	–		√	√									
92	Myrtaceae	*Syzygium malaccense* L.	Jambu bol	+	+	+			–	–	–	√			√								
93	Oxalidaceae	*Averrhoa carambola* L.	Belimbing						–	–	–			√	√								
94	Pandanaceae	*Pandanus amaryllifolius*	Pandan wangi				+	+	–	–	–			√	√	√							
95	Phyllantaceae	*Phyllanthus acidus* L.	Ceremai		+				–	–	–				√								
96	Pinaceae	*Pinus merkusii*	Pinus	+	+	+			–	–	VU*	√	√								√		√
97	Piperaceae	*Piper aduncum* L.	Kiseureuh			+			–	–	–	√	√	√	√	√					√	√	√
98	Plantaginaceae	*Plantago major* L.	Ki urat					+	–	–		√	√	√	√								√
99	Poaceae	*Axonopus compressus*	Jukut Pait					+	–	–	–	√	√	√	√						√	√	√
100	Poaceae	*Saccharum officinarum* L.	Tebu				+		–	–	–						√						
101	Poaceae	*Pennisetum purpureum*	Rumput gajah					+	–	–	–	√	√	√		√	√				√	√	√
102	Poaceae	*Cyperus rotundus* L.	Rumput Teki					+	–	–		√	√	√	√						√	√	
103	Poaceae	*Imperata cylindrica* (L.)	Alang-alang					+	–	–	–	√	√	√	√	√	√	√	√	√	√	√	√
104	Poaceae	*Zea mays* ssp. *Mays* (L.)	Jagung					+	–	–	–	√	√	√							√		
105	Poaceae	*Saccharum spontaneum* L.	Kaso					+	–	–	–	√	√	√									
106	Poaceae	*Bambusa vulgaris*	Bambu haur hijau					+	–	–	–	√			√								√

No.	Famili	Nama Ilmiah	Nama Daerah	Kategori					Permen	CITES	IUCN	Lokasi											
				Po	Ti	Pc	Sm	Tb				1	2	3	4	5	6	7	8	9	10	11	12
107	Poaceae	*Gigantochloa apus*	Bambu tali					+	–	–	–	√	√	√	√	√					√	√	√
108	Poaceae	*Oryza sativa* L.	Padi					+	–	–	–	√	√	√	√		√	√	√	√	√	√	
109	Rhamnaceae	*Maesopsis eminii* Engl.	Sobsi	+	+	+			–	–	–	√	√	√	√	√					√	√	√
110	Rubiaceae	*Neolamarckia cadamba*	Jabon		+				–	–	–			√	√								√
111	Rubiaceae	*Coffea canephora*	Kopi			+			–	–	LC	√	√	√	√							√	√
112	Rutaceae	*Citrus × hystrix* L.	Jeruk purut				+		–	–	–		√		√								
113	Sapindaceae	*Nephelium lappaceum* L.	Rambutan	+		+			–	–	LC			√	√								√
114	Selaginellaceae	*Selaginella plana*	Rane					+	–	–	–	√	√	√	√						√	√	√
115	Solanaceae	*Solanum melongena* L.	Terong				+		–	–	–		√		√								
116	Solanaceae	*Solanum torvum* Sw.	Takokak					+	–	–	–	√	√	√	√	√				√	√	√	√
117	Urticaceae	*Oreocnide rubescens*	Nangsi				+		–	–	LC	√	√								√	√	√
118	Verbenaceae	*Lantana camara* L.	Saliara				+	+	–	–	–	√	√	√	√	√	√	√	√	√	√	√	√
119	Zingiberaceae	*Etlingera elatior*	Honje					+	–	–	DD		√									√	
120	Zingiberaceae	*Etlingera coccinea*	Tepus					+	–	–	LC	√	√	√	√						√	√	√
121	Fabaceae	Delonix regia	Flamboyan																√				
	49 Famili	**Jumlah**									VU = 2	76	78	69	93	55	26	23	23	24	65	72	83

Sumber : Data Primer, 2020

Keterangan:

Kategori Po : Pohon, Ti : Tiang, Pc : Pancang, Sm : Semai, Tb : Tumbuhan bawah

* bukan jenis alami (tanaman yang sengaja ditanam sebagai tanaman kehutanan atau penghijauan

Status Konservasi:

- Peraturan Menteri Lingkungan Hidup dan Kehutanan Republik Indonesia Nomor P.106/MENLHK/SETJEN/KUM.1/6/2018 Tentang Perubahan Kedua atas Peraturan Menteri Lingkungan Hidup dan Kehutanan Nomor P.20/MENLHK/SETJEN/KUM.1/6/2018 Tentang Jenis Tumbuhan dan Satwa yang Dilindungi.
- Status Konservasi dunia - IUCN (*International Union of Conservation of Nature*): NT: near threatened; EN: Endangered ; VU: Vulnerable ; LC: Least Concern, DD: Data Deficient
- Status perdagangan jenis terancam - CITES (*Convention on International Trade in Endangered Species*); Status I = Appendix I; Status II = Appendix II; Status III = Appendix III

Table A3. List of Mammal Species in the UCPS area

No	Family	Species	Nama lokal/Inggris	Status konservasi				TD	Lokasi										
				RI	IUCN	E	CITES		13	14	15	16	17	18	19	20	21	22	23
1	Suidae	*Sus scrofa* (Linnaeus, 1758)	Babi celeng/Wild Boar		LC			I	×	×	×	×	×	×	×	×	×	×	×
2	Tragulidae	*Tragulus javanicus* (Osbeck, 1765)	Pelanduk kancil/ Lesser Mouse-Deer	√	LC			I	×	×	×	×	–	–	×	–	–	–	–
3	Mustelidae	*Aonyx cinerea* (Illiger, 1815)	Sero ambrang/ Oriental Small-clawed Otter		VU		AP III	I	–	–	–	–	×	–	×	×	–	–	–
4	Viverridae	*Paradoxurus hermaphrodites* (Pallas, 1777).	Musang luwak/ Common Palm Civet		LC		AP III	I, F	×	×	×	×	×	×	×	×	×	×	×
5	Herpestidae	*Herpestes javanicus* (E. Geoffroy Saint-Hilaire 1818)	Garangan Jawa/ Small Asian Mongoose		LC		AP III	O	–	–	–	–	×	–	–	×	–	–	–
6	Felidae	*Prionailurus bengalensis* (Kerr, 1792)	Meong congkok/ Leopard Cat	√	LC		AP I	I	–	–	–	–	×	–	–	×	–	–	–
7	Felidae	*Panthera pardus melas* (Cuvier, 1809)	Macan tutul jawa/ Javan Leopard	√	VU		AP I	I	–	–	–	–	×	–	–	×	–	–	–
8	Pteropodidae	*Pteropus vampyrus* (Linnaeus, 1758)	Kalong/ Large Flying Fox		NT			O	×	×	×	×	×	×	×	×	–	–	–
9	Pteropodidae	*Cynopterus brachyotis* (Muller, 1838)	Codot krawar/ Lesser short-nosed fruit bat		LC			O	×	×	×	×	×	×	×	×	×	×	×
10	Pteropodidae	*Cynopterus sphinx* (Vahl, 1797)	Codot barong/ Short-nosed Indian Fruit Bat		LC			O	×	×	×	×	×	×	×	×	×	×	×
11	Manidae	*Manis javanica* (Desmarest, 1822)	Trenggiling/ Pangolin	√	CR		AP I	I	–	–	–	–	×	×	×	×	–	–	–
12	Cercopithecidae	*Macaca fascicularis* (Raffles, 1821)	Monyet kera/Long-tailed Macaque		LC		AP III	O, I	×	×	×	×	×	×	×	×	–	–	–
13	Cercopithecidae	*Presbytis comata* (Desmarest, 1822)	Surili/ Grizzled Leaf Monkey	√	EN,	J	AP II	O, I	–	–	–	–	×	×	–	×	–	–	–
14	Cercopithecidae	*Trachypithecus auratus* (É. Geoffroy Saint-Hilaire, 1812)	Lutung budeng/ Javan Langur	√	VU,	J	AP II	O, W	×	×	×	×	×	×	×	×	–	–	–
15	Hylobatidae	*Hylobates moloch* (Audebert, 1798)	Owa Jawa/ Javan Gibbon	√	EN,	J		O, I	–	–	–	–	–	–	–	×	–	–	–
16	Lorisidae	*Nycticebus javanicus* (Boddaert, 1785)	Kukang/ Slow Loris	√	CR		AP I	I	×	×	–	×	×	–	–	×	–	–	–
17	Sciurade	*Callosciurus notatus* (Boddaert, 1785)	Bajing kelapa/ Plantain Squirrel		NT			O	×	×	×	×	×	×	×	×	×	×	×
18	Sciurade	*Ratufa bicolor* (Sparrman, 1778)	Jelarang hitam/ Giant Squirrel		NT		AP II	I	–	–	–	–	×	–	–	×	–	–	×
19	Hystricidae	Hystrix javanica (F. Cuvier, 1823)	Landak jawa/ Javan Porcupine	√	LC		AP III	I	–	–	–	×	×	×	×	×	–	–	–
20	Tupaidae	*Tupaia javanica* (Horsfield, 1822)	Tupai kekes/ Javan Treeshrew		LC	J	AP II	O	×	×	×	×	×	×	×	×	×	×	×
21	Sciuridae	*Petaurista petaurista Pallas*	Tando/Esquirol volador gegant		LC		AP II	I	–	–	–	–	–	×	–	×	–	–	–
22	Viverridae	*Paguma larvata* (C. E. H. Smith, 1827)	Careh bulan/Masked palm civet		LC		AP II	I	–	–	–	–	–	–	–	×	–	–	–
	15 Family	**Total**		**9**	**CR = 2** **EN = 2**	**4**	**AP I = 4** **AP II = 6**		**11**	**11**	**10**	**12**	**18**	**13**	**13**	**21**	**6**	**6**	**7**

No	Family	Species	Nama lokal/Inggris	Status konservasi				TD	Lokasi										
				RI	IUCN	E	CITES		13	14	15	16	17	18	19	20	21	22	23
					VU = 3		**AP III = 5**												

Table A4. List of Mammal species along the Transmission Line footprint

No	Family	Species	Local/Common name	Conservation status				ST	Location											
				RI	IUCN	E	CITES		1	2	3	4	5	6	7	8	9	10	11	12
1	Suidae	*Sus scrofa* (Linnaeus, 1758)	Babi celeng/Wild Boar		LC			I	×	×	×	×	×	–	–	–	–	×	×	×
2	Tragulidae	*Tragulus javanicus* (Osbeck, 1765)	Pelanduk kancil/ Lesser Mouse-Deer	√	LC			I	×	×	–	–	–	–	–	–	–	×	×	×
3	Mustelidae	*Aonyx cinerea* (Illiger, 1815)	Sero ambrang/ Oriental Small-clawed Otter		VU		AP III	I	–	×	×	–	–	–	–	–	–	–	–	–
4	Viverridae	*Paradoxurus hermaphrodites* (Pallas, 1777).	Musang luwak/ Common Palm Civet		LC		AP III	I/F	×	×	×	–	–	–	–	–	×	×	×	×
5	Herpestidae	*Herpestes javanicus* (E. Geoffroy Saint-Hilaire 1818)	Garangan Jawa/ Small Asian Mongoose		LC		AP III	O	×	×	–	–	–	–	–	–	–	–	–	–
6	Pteropodidae	*Pteropus vampyrus* (Linnaeus, 1758)	Kalong/ Large Flying Fox		NT			O	×	×	×	–	–	–	–	–	×	×	×	×
7	Pteropodidae	*Cynopterus brachyotis* (Muller, 1838)	Codot krawar/ Lesser short-nosed fruit bat		LC			O	×	×	×	×	×	×	×	×	×	×	×	×
8	Pteropodidae	*Cynopterus sphinx* (Vahl, 1797)	Codot barong/ Short-nosed Indian Fruit Bat		LC			O	×	×	×	×	×	×	×	×	×	×	×	×
9	Manidae	*Manis javanica* (Desmarest, 1822)	Trenggiling/ Pangolin	√	CR		AP I	I	×	×	×	–	–	–	–	–	×	×	×	×
10	Cercopithecidae	*Macaca fasciculari*s (Raffles, 1821)	Monyet kera/Long-tailed Macaque		LC		AP III	O, I	×	×	×	–	–	–	–	–	×	×	×	×
11	Cercopithecidae	*Presbytis comata* (Desmarest, 1822)	Surili/ Grizzled Leaf Monkey	√	EN	J	AP II	O, I	–	×	×	–	–	–	–	–	–	–	×	–
12	Cercopithecidae	*Trachypithecus auratus* (É. Geoffroy Saint-Hilaire, 1812)	Lutung budeng/ Javan Langur	√	VU	J	AP II	O, I	–	×	–	–	–	–	–	–	–	×	×	×
13	Lorisidae	*Nycticebus javanicus* (Boddaert, 1785)	Kukang/ Slow Loris	√	CR		AP I	I	×	×	×	–	–	–	–	–	–	–	–	–
14	Sciurade	*Callosciurus notatus* (Boddaert, 1785)	Bajing kelapa/ Plantain Squirrel		NT			O	×	×	×	×	×	×	×	×	×	×	×	×
15	Hystricidae	Hystrix javanica (F. Cuvier, 1823)	Landak jawa/ Javan Porcupine	√	LC		AP III	I	×	×	–	–	–	–	–	–	–	–	–	–
16	Tupaidae	*Tupaia javanica* (Horsfield, 1822)	Tupai kekes/ Javan Treeshrew		LC	J	AP II	O	×	×	×	×	×	–	×	×	–	×	×	×
	12 Family	**Total**		**6**	**CR = 2** **EN = 1** **VU = 2**	**3**	**AP I = 2** **AP II = 3** **AP III = 5**		**13**	**16**	**12**	**5**	**5**	**3**	**4**	**4**	**7**	**11**	**12**	11

Sumber : Data Primer, 2020
Information:
Conservation status:
- Regulation of the Minister of Environment and Forestry of the Republic of Indonesia Number P.106/MENLHK/SETJEN/KUM.1/6/2018 Concerning the Second Amendment to Regulation of the Minister of Environment and Forestry Number P.20/MENLHK/SETJEN/KUM.1/6/2018 regarding Protected Types of Plants and Animals.
- Conservation status - IUCN (*International Union of Conservation of Nature*): NT: Near threatened; EN: Endangered ; VU: Vulnerable ; LC: Least Concern, DD: Data Deficient
  Trade status of threatened species - CITES (*Convention on International Trade in Endangered Species*); Status I = Appendix I; Status II = Appendix II; Status III = Appendix III
  E ; Endemic.
  Survey technique (ST) – I (interview); O (direct observation); F (footprint)

Table A5. List of Herpetofauna in UCPS

No.	Kelas | Ordo | Famili | *Nama Ilmiah*	Nama Umum	Status			Tipe Data
			PERMEN	IUCN	CITES	
	AMFIBIA					
	ANURA					
	Bufonidae					
1	*Duttaphrynus melanostictus*	Kodok budug		LC		O
	Dicroglossidae					
2	*Fejervarya cancrivora*	Katak sawah		LC		O
3	*Fejervarya limnocahris*	Katak tegalan		LC		O
	Rhacophoridae					
4	*Polypedates leucomystax*	Katak pohon bergaris		LC		O
	REPTILIA					
	SQUAMATA					
	Agamidae					
5	*Bronchocela cristatella*	Bunglon pohon				O
6	*Bronchocela jubata*	Bunglon pohon		LC		O
7	*Draco volans*	Haphap				O
	Gekkonidae					
8	*Cyrtodactylus marmoratus*	Cicak batu				O
9	*Gehyra mutilata*	Cicak rumah				O

No.	Kelas | Ordo | Famili | *Nama Ilmiah*	Nama Umum	Status			Tipe Data
			PERMEN	IUCN	CITES	
10	*Gekko gecko*	Tokek		LC		O
11	*Hemidactylus frenatus*	Cicak rumah		LC		O
	Lacertidae					
12	*Takydromus sexlineatus*	Orong-orong		LC		O
	Scincidae					
13	*Eutropis multifasciata*	Kadal				O
14	*Sphenomorphus sanctus*	Kadal pohon				O
	Varanidae					
15	*Varanus salvator*	Biawak		LC	II	W
	Pythonidae					
16	*Python molurus*	Sanca bodo			II	W
17	*Malayopython reticulatus*	Sanca kembang			II	W
	Colubridae					
18	*Ahaetulla prasina*	Ular pucuk				W
19	*Dendrelaphis pictus*	Ular tambang		LC		W
20	*Gongylosoma beliodeirus*	Oray lemah				W
21	*Gonyophis oxycephalum*	Oray hejo bamban		LC		W
22	*Lycodon subcinctus*					W
23	*Ptyas carinata*	Ular koros/Oray sawah		LC		W
24	*Ptyas korros*	Ular koros/Oray sawah		LC		W
	Viperidae					
25	*Trimeresurus puniceus*	Oray gibug		LC		W
	Elapidae					
26	*Bungarus candidus*	Ular weling		LC		W
27	*Calliophis intestinalis*	Oray cabe		LC		W
28	*Ophiophagus hannah*	King Cobra		VU	II	W

No.	Kelas | Ordo | Famili | *Nama Ilmiah*	Nama Umum	Status			Tipe Data
			PERMEN	IUCN	CITES	
	Natricidae					
29	*Enhydris plumbea*	Ular picung		LC		W
	JUMLAH			**VU = 1** **LC = 17**	**4**	

Sumber : Data Primer, 2020
Keterangan:
Status Konservasi:

- Peraturan Menteri Lingkungan Hidup dan Kehutanan Republik Indonesia Nomor P.106/MENLHK/SETJEN/KUM.1/6/2018 Tentang Perubahan Kedua atas Peraturan Menteri Lingkungan Hidup dan Kehutanan Nomor P.20/MENLHK/SETJEN/KUM.1/6/2018 Tentang Jenis Tumbuhan dan Satwa yang Dilindungi.
- Status Konservasi dunia - IUCN (*International Union of Conservation of Nature*): NT: near threatened; EN: Endangered ; VU: Vulnerable ; LC: Least Concern, DD: Data Deficient

Table A6. List of Herpetofauna in Transmission Line area

No.	Kelas | Ordo | Famili | *Nama Ilmiah*	Nama Umum	Status			Tipe Data
			PERMEN	IUCN	CITES	
	AMFIBIA					
	ANURA					
	Bufonidae					
1	*Duttaphrynus melanostictus*	Kodok budug		LC		O
	Dicroglossidae					
2	*Fejervarya cancrivora*	Katak sawah		LC		O
3	*Fejervarya limnocahris*	Katak tegalan		LC		O
	Rhacophoridae					
4	*Polypedates leucomystax*	Katak pohon bergaris		LC		O
	REPTILIA					
	SQUAMATA					
	Agamidae					

No.	Kelas | Ordo | Famili | *Nama Ilmiah*	Nama Umum	Status			Tipe Data
			PERMEN	IUCN	CITES	
5	*Bronchocela cristatella*	Bunglon pohon				O
6	*Bronchocela jubata*	Bunglon pohon		LC		O
7	*Draco volans*	Haphap				O
	Gekkonidae					
8	*Cyrtodactylus marmoratus*	Cicak batu				O
9	*Gehyra mutilata*	Cicak rumah				O
10	*Gekko gecko*	Tokek		LC		O
11	*Hemidactylus frenatus*	Cicak rumah		LC		O
	Lacertidae					
12	*Takydromus sexlineatus*	Orong-orong		LC		O
	Scincidae					
13	*Eutropis multifasciata*	Kadal				O
14	*Sphenomorphus sanctus*	Kadal pohon				O
	Varanidae					
15	*Varanus salvator*	Biawak		LC	II	W
	Pythonidae					
16	*Python molurus*	Sanca bodo			II	W
17	*Malayopython reticulatus*	Sanca kembang			II	W
	Colubridae					
18	*Ahaetulla prasina*	Ular pucuk				W
19	*Dendrelaphis pictus*	Ular tambang		LC		W
20	*Gongylosoma beliodeirus*	Oray lemah				W
21	*Gonyophis oxycephalum*	Oray hejo bamban		LC		W
22	*Lycodon subcinctus*					W
23	*Ptyas carinata*	Ular koros/Oray sawah		LC		W
24	*Ptyas korros*	Ular koros/Oray sawah		LC		W

No.	Kelas | Ordo | Famili | *Nama Ilmiah*	Nama Umum	Status			Tipe Data
			PERMEN	IUCN	CITES	
	Viperidae					
25	*Trimeresurus puniceus*	Oray gibug		LC		W
	Elapidae					
26	*Bungarus candidus*	Ular weling		LC		W
27	*Calliophis intestinalis*	Oray cabe		LC		W
28	*Ophiophagus hannah*	King Cobra		VU	II	W
	Natricidae					
29	*Enhydris plumbea*	Ular picung		LC		W
	JUMLAH			**VU = 1** **LC = 17**	**4**	

Sumber : Data Primer, 2020

Keterangan:

Status Konservasi:

- Peraturan Menteri Lingkungan Hidup dan Kehutanan Republik Indonesia Nomor P.106/MENLHK/SETJEN/KUM.1/6/2018 Tentang Perubahan Kedua atas Peraturan Menteri Lingkungan Hidup dan Kehutanan Nomor P.20/MENLHK/SETJEN/KUM.1/6/2018 Tentang Jenis Tumbuhan dan Satwa yang Dilindungi.
- Status Konservasi dunia - IUCN (*International Union of Conservation of Nature*): NT: near threatened; EN: Endangered ; VU: Vulnerable ; LC: Least Concern, DD: Data Deficient

Table A7. List of Avifauna in UCPS

No	Famili	Nama Jenis	Nama Ilmiah	Nama Inggris	Permen	IUCN	CITES	Endemisitas	Lokasi										
									13	14	15	16	17	18	19	20	21	22	23
1	Accipitridae	Sikepmadu Asia	*Pernis ptilorhynchus* (Temminck, 1821)	Crested Honey Buzzard	√	LC	II	M						√					
2		Elangular Bido	*Spilornis cheela* (Latham, 1790)	Crested Serpent Eagle	√	LC	II		√	√	√	√	√	√	√	√	√	√	√
3		Elangalap Besra	*Accipiter virgatus* (Temminck, 1822)	Besra	√	LC	II								√				
4		Elang Hitam	*Ictinaetus malayensis* (Temminck, 1822)	Black Eagle	√	LC	II					√							
5		Elang Brontok	*Nisaetus cirrhatus* (Gmelin, 1788)	Crested Hawk-Eagle	√	LC	II							√				√	
6	Falconidae	Alapalap Capung	*Microhierax fringillarius* (Drapiez, 1824)	Black-thighed Falconet	√	LC	II											√	
7	Turnicidae	Gemak Loreng	*Turnix suscitator* (Gmelin, 1789)	Barred Buttonquail		LC						√							
8	Scolopacidae	Trinil Pantai	*Actitis hypoleucos* (Linnaeus, 1758)	Common Sandpiper		LC								√					
9	Columbidae	Punai Lengguak	*Treron curvirostra* (Gmelin, 1789)	Thick-billed Green Pigeon		LC												√	
10		Tekukur Biasa	*Spilopelia chinensis* (Scopoli, 1786)	Spotted Dove		LC			√	√	√	√	√	√	√	√	√	√	√
11		Delimukan Zamrud	*Chalcophaps indica* (Linnaeus, 1758)	Common Emerald Dove		LC												√	
12	Cuculidae	Wiwik Lurik	*Cacomantis sonneratii* (Latham, 1790)	Banded Bay Cuckoo		LC							√						
13		Wiwik Kelabu	*Cacomantis merulinus* (Scopoli, 1786)	Plaintive Cuckoo		LC			√	√	√	√	√	√	√	√	√	√	√
14		Wiwik Uncuing	*Cacomantis sepulcralis* (S. Müller, 1843)	Rusty-breasted Cuckoo		LC			√	√	√	√	√	√	√	√	√	√	√
15		Kedasi Hitam	*Surniculus lugubris (Horsfield, 1821)*	Asian Drongo-Cuckoo		LC			√	√	√	√	√	√	√	√			
16		Kadalan Birah	*Rhamphococcyx curvirostris* Shaw, 1810	Chestnut-breasted Malkoha		LC										√			
17		Bubut Besar	*Centropus sinensis* Stephens, 1815	Greater Coucal		LC						√							
18		Bubut Alang-alang	*Centropus bengalensis* Gmelin, 1788	Lesser Coucal		LC			√	√	√	√	√	√	√	√	√	√	√
19	Strigidae	Celepuk Reban	*Otus lempiji* (Horsfield, 1821)	Sunda Scops Owl		LC	II					√							
20	Caprimulgidae	Cabak Kota	*Caprimulgus affinis* Horsfield, 1821	Savanna Nightjar		LC								√					
21	Apodidae	Walet Linci	*Collocalia linchi* (Horsfield & F. Moore, 1854)	Cave Swiftlet		LC			√	√	√	√	√	√	√	√	√	√	√

No	Famili	Nama Jenis	Nama Ilmiah	Nama Inggris	Permen	IUCN	CITES	Endemisitas	Lokasi										
									13	14	15	16	17	18	19	20	21	22	23
22		Kapinis Rumah	*Apus nipalensis* (Hodgson, 1837)	House Swift		LC			√	√	√	√	√	√	√	√	√	√	√
23	Alcedinidae	Cekakak Jawa	*Halcyon cyanoventris* (Vieillot, 1818)	Javan Kingfisher		LC		E				√	√	√	√	√	√	√	√
24		Cekakak Sungai	*Todiramphus chloris* Boddaert, 1783	Collared Kingfisher		LC						√	√	√					
25	Capitonidae	Takur Tulung-tumpuk	*Psilopogon javensis* Horsfield, 1821	Black-banded Barbet	√	NT		E				√	√	√	√	√			
26		Takur Tohtor	*Psilopogon armillaris* Temminck, 1821	Flame-fronted Barbet	√	LC		E				√	√	√	√	√			
27		Takur Tenggeret	*Psilopogon australis* Horsfield, 1821	Yellow-eared Barbet		LC						√	√	√	√	√	√	√	√
28	Picidae	Caladi Ulam	*Dendrocopos macei* Vieillot, 1818	Fulvous-breasted Woodpecker		LC			√	√	√	√	√	√	√	√	√	√	√
29		Caladi Tilik	*Dendrocopos moluccensis* Gmelin, 1788	Sunda Pygmy Woodpecker		LC											√	√	√
30	Eurylaimidae	Sempurhujan Rimba	*Eurylaimus javanicus* Horsfield, 1821	Banded Broadbill		NT										√			
31	Pittidae	Paok Pancawarna	*Hydornis guajanus* P. L. S. Müller, 1776	Javan Banded Pitta	√	LC	II					√	√	√	√	√			
32	Hirundinidae	Layanglayang Batu	*Hirundo tahitica* Gmelin, 1789	Pacific Swallow		LC			√	√	√	√	√	√	√	√	√	√	√
33		Layanglayang Loreng	*Cecropis striolata* Temminck & Schlegel, 1847	Striated Swallow		LC			√	√	√	√	√	√	√	√	√	√	√
34	Motacillidae	Kicuit Batu	*Motacilla cinerea* Tunstall, 1771	Grey Wagtail		LC		M					√			√		√	
35	Campephagidae	Sepah Hutan	*Pericrocotus flammeus* (J. R. Forster, 1781)	Scarlet Minivet		LC										√			
36		Jingjing Batu	*Hemipus hirundinaceus* (Temminck, 1822)	Black-winged Flycatcher-shrike		LC										√			
37	Aegithinidae	Cipoh Kacat	*Aegithina tiphia* (Linnaeus, 1758)	Common Iora		LC										√			
38		Cucak Kutilang	*Pycnonotus aurigaster* (Jardine & Selby, 1837)	Sooty-headed Bulbul		LC			√	√	√	√	√	√	√	√	√	√	√
39		Merbah Cerukcuk	*Pycnonotus goiavier* (Scopoli, 1786)	Yellow-vented Bulbul		LC			√	√	√	√	√	√	√	√	√	√	√
40		Empuloh Janggut	*Criniger bres* (Lesson, 1831)	Grey-cheeked Bulbul		LC				√									
41	Laniidae	Bentet Kelabu	*Lanius schach* Linnaeus, 1758	Long-tailed Shrike		LC			√	√	√	√	√	√	√	√	√	√	√
42	Turdidae	Kucica Hutan	*Kittacincla malabarica* (Scopoli, 1786)	White-rumped Shama		LC										√			
43		Meninting Besar	*Enicurus leschenaulti* (Vieillot, 1818)	White-crowned Forktail		LC										√			

No	Famili	Nama Jenis	Nama Ilmiah	Nama Inggris	Permen	IUCN	CITES	Endemisitas	Lokasi										
									13	14	15	16	17	18	19	20	21	22	23
44	Timaliidae	Pelanduk Topi-hitam	*Pellorneum capistratum* (Temminck, 1823)	Black-capped Babbler		LC						√	√	√					
45		Pelanduk Semak	*Malacocincla sepiarium* (Horsfield, 1821)	Horsfield's Babbler		LC						√	√	√					
46		Tepus Pipi-perak	*Cyanoderma melanothorax* (Temminck, 1823)	Crescent-chested Babbler		LC						√	√	√					
47		Tepus Gelagah	*Timalia pileata* Horsfield, 1821	Chestnut-capped Babbler		LC						√	√	√	√	√	√	√	√
48		Perenjak Coklat	*Prinia polychroa* (Temminck, 1828)	Brown Prinia		LC												√	
49		Perenjak Jawa	*Prinia familiaris* Horsfield, 1821	Bar-winged Prinia		NT			√	√	√	√	√	√	√	√			
50		Perenjak padi	*Prinia inornata* Sykes, 1832	Plain Prinia		LC													√
51		Cinenen Pisang	*Orthotomus sutorius* (Pennant, 1769)	Common Tailorbird		LC					√	√	√	√	√	√	√	√	√
52		Cinenen Jawa	*Orthotomus sepium* Horsfield, 1821	Olive-backed Tailorbird		LC		E	√	√	√	√	√	√	√	√	√	√	√
53	Muscicapidae	Sikatan Bubik	*Muscicapa dauurica* Pallas, 1811	Asian Brown Flycatcher		LC		M						√					
54	Sittidae	Munguk Loreng	*Sitta azurea* Lesson, 1830	Blue Nuthatch		LC										√			
55	Dicaeidae	Cabai Bunga-api	*Dicaeum trigonostigma* (Scopoli, 1786)	Orange-bellied Flowerpecker		LC			√	√	√	√	√	√	√	√	√	√	√
56		Cabai Jawa	*Dicaeum trochileum* (Sparrman, 1789)	Scarlet-headed Flowerpecker		LC		E	√	√	√	√	√	√	√	√	√	√	√
57	Nectariniidae	Burungmadu Kelapa	*Anthreptes malacensis* (Scopoli, 1786)	Brown-throated Sunbird		LC			√	√	√	√	√	√	√	√	√	√	√
58		Burungmadu Sriganti	*Cinnyris jugularis* (Linnaeus, 1766)	Olive-backed Sunbird		LC			√	√	√	√	√	√	√	√	√	√	√
59		Burungmadu Sepah-raja	*Aethopyga siparaja* (Raffles, 1822)	Crimson Sunbird	√	LC								√					
60		Pijantung Kecil	*Arachnothera longirostra* (Latham, 1790)	Little Spiderhunter		LC								√					
61	Zosteropidae	Kacamata Biasa	*Zosterops palpebrosus* (Temminck, 1824)	Oriental White-eye		LC								√					
62	Estrildidae	Bondol Jawa	*Lonchura leucogastroides* (Horsfield & Moore, 1858)	Javan Munia		LC		E						√					
63		Bondol Peking	*Lonchura punctulata* (Linnaeus, 1758)	Scaly-breasted Munia		LC								√					
64	Ploceidae	Burunggereja Erasia	*Passer montanus* (Linnaeus, 1758)	Eurasian Tree Sparrow		LC			√	√	√	√	√	√	√	√	√	√	√
65	Dicruridae	Srigunting Hitam	*Dicrurus macrocercus* Vieillot, 1817	Black Drongo		LC							√	√				√	

No	Famili	Nama Jenis	Nama Ilmiah	Nama Inggris	Permen	IUCN	CITES	Endemisitas	Lokasi										
									13	14	15	16	17	18	19	20	21	22	23
66		Srigunting Kelabu	*Dicrurus leucophaeus* Vieillot, 1817	Ashy Drongo		LC			√	√	√	√	√	√	√	√	√	√	√
67	Artamidae	Kekep Babi	*Artamus leucorynchus* (Linnaeus, 1771)	White-breasted Woodswallow		LC								√					
	30 Famili	**Jumlah**			**10**	**LC = 64**	**8**	**E = 6**	**22**	**23**	**23**	**37**	**36**	**44**	**30**	**38**	**25**	**25**	**26**
						NT = 3		**M = 3**											

Sumber : Data Primer, 2020

Keterangan:

Status Konservasi:

- Peraturan Menteri Lingkungan Hidup dan Kehutanan Republik Indonesia Nomor P.106/MENLHK/SETJEN/KUM.1/6/2018 Tentang Perubahan Kedua atas Peraturan Menteri Lingkungan Hidup dan Kehutanan Nomor P.20/MENLHK/SETJEN/KUM.1/6/2018 Tentang Jenis Tumbuhan dan Satwa yang Dilindungi.
- Status Konservasi dunia - IUCN (*International Union of Conservation of Nature*): NT: near threatened; EN: Endangered ; VU: Vulnerable ; LC: Least Concern, DD: Data Deficient
- Status perdagangan jenis terancam - CITES (*Convention on International Trade in Endangered Species*); Status I = Appendix I; Status II = Appendix II; Status III = Appendix III
- Status Endemisitas ; E = Endemik, M = Migran

Table A8. List of Avifauna in Transmission Line area

No	Famili	Nama Jenis	Nama Ilmiah	Nama Inggris	Permen	IUCN	CITES	Endsm	Lokasi											
									1	2	3	4	5	6	7	8	9	10	11	12
1	Ardeidae	Bambangan Merah	*Ixobrychus cinnamomeus* (Gmelin, 1789)	Cinnamon Bittern		LC										√				
2	Accipitridae	Sikepmadu Asia	*Pernis ptilorhynchus* (Temminck, 1821)	Crested Honey Buzzard	√	LC	II	M		√										
3		Elangular Bido	*Spilornis cheela* (Latham, 1790)	Crested Serpent Eagle	√	LC	II		√	√		√						√	√	√
4		Elang Hitam	*Ictinaetus malayensis* (Temminck, 1822)	Black Eagle	√	LC	II		√											
5		Elang Brontok	*Nisaetus cirrhatus* (Gmelin, 1788)	Crested Hawk-Eagle	√	LC	II			√	√									
6	Rallidae	Kareo Padi	*Amaurornis phoenicurus* (Pennant, 1769)	White-breasted Waterhen		LC								√	√	√	√			
7		Tekukur Biasa	*Spilopelia chinensis* (Scopoli, 1786)	Spotted Dove		LC			√	√	√	√	√	√	√	√	√	√	√	√
8		Perkutut Jawa	*Geopelia striata* (Linnaeus, 1766)	Zebra Dove		LC				√										
9	Cuculidae	Wiwik Lurik	*Cacomantis sonneratii* (Latham, 1790)	Banded Bay Cuckoo		LC							√							
10		Wiwik Kelabu	*Cacomantis merulinus* (Scopoli, 1786)	Plaintive Cuckoo		LC			√	√	√	√	√	√				√	√	√
11		Wiwik Uncuing	*Cacomantis sepulcralis* (S. Müller, 1843)	Rusty-breasted Cuckoo		LC				√										
12		Kedasi Hitam	*Surniculus lugubris (Horsfield, 1821)*	Asian Drongo-Cuckoo		LC				√										
13		Kadalan Birah	*Rhamphococcyx curvirostris* Shaw, 1810	Chestnut-breasted Malkoha		LC				√										
14		Bubut Alang-alang	*Centropus bengalensis* Gmelin, 1788	Lesser Coucal		LC							√							
15	Strigidae	Celepuk Reban	*Otus lempiji* (Horsfield, 1821)	Sunda Scops Owl		LC	II		√											
16	Caprimulgidae	Cabak Kota	*Caprimulgus affinis* Horsfield, 1821	Savanna Nightjar		LC			√								√			
17	Apodidae	Walet Linci	*Collocalia linchi* (Horsfield & F. Moore, 1854)	Cave Swiftlet		LC			√	√	√	√	√	√	√	√	√	√	√	√
18		Kapinis Rumah	*Apus nipalensis* (Hodgson, 1837)	House Swift		LC			√	√	√	√	√	√	√	√	√	√	√	√
19	Alcedinidae	Cekakak Jawa	*Halcyon cyanoventris* (Vieillot, 1818)	Javan Kingfisher		LC		E			√	√	√							
20		Cekakak Sungai	*Todiramphus chloris* Boddaert, 1783	Collared Kingfisher		LC			√	√										
21		Takur Tenggeret	*Psilopogon australis* Horsfield, 1821	Yellow-eared Barbet		LC			√	√										

No	Famili	Nama Jenis	Nama Ilmiah	Nama Inggris	Permen	IUCN	CITES	Endsm	Lokasi											
									1	2	3	4	5	6	7	8	9	10	11	12
22	Picidae	Caladi Ulam	*Dendrocopos macei* Vieillot, 1818	Fulvous-breasted Woodpecker		LC				√	√	√	√							
23		Caladi Tilik	*Dendrocopos moluccensis* Gmelin, 1788	Sunda Pygmy Woodpecker		LC			√											
24	Eurylaimidae	Sempurhujan Rimba	*Eurylaimus javanicus* Horsfield, 1821	Banded Broadbill		NT			√											
25		Layanglayang Asia	*Hirundo rustica* Linnaeus, 1758	Barn Swallow		LC		M						√	√	√	√			
26	Hirundinidae	Layanglayang Batu	*Hirundo tahitica* Gmelin, 1789	Pacific Swallow		LC			√	√	√	√	√	√	√	√	√	√	√	√
27		Layanglayang Loreng	*Cecropis striolata* Temminck & Schlegel, 1847	Striated Swallow		LC			√	√	√	√	√	√	√	√	√	√	√	√
28	Motacillidae	Kicuit Batu	*Motacilla cinerea* Tunstall, 1771	Grey Wagtail		LC		M												
29	Pycnonotidae	Cucak Kuricang	*Pycnonotus atriceps* (Temminck, 1822)	Black-headed Bulbul		LC											√			
30		Cucak Kutilang	*Pycnonotus aurigaster* (Jardine & Selby, 1837)	Sooty-headed Bulbul		LC			√	√	√	√	√	√	√	√	√	√	√	√
31		Merbah Cerukcuk	*Pycnonotus goiavier* (Scopoli, 1786)	Yellow-vented Bulbul		LC			√	√	√	√	√							
32		Empuloh Janggut	*Criniger bres* (Lesson, 1831)	Grey-cheeked Bulbul		LC				√										
33	Laniidae	Bentet Kelabu	*Lanius schach* Linnaeus, 1758	Long-tailed Shrike		LC					√		√							
34		Meninting Besar	*Enicurus leschenaulti* (Vieillot, 1818)	White-crowned Forktail		LC				√										
35		Tepus Pipi-perak	*Cyanoderma melanothorax* (Temminck, 1823)	Crescent-chested Babbler		LC							√							
36	Sylviidae	Cici Padi	*Cisticola juncidis* (Rafinesque, 1810)	Zitting Cisticola		LC						√	√	√	√	√	√			
37		Perenjak Coklat	*Prinia polychroa* (Temminck, 1828)	Brown Prinia		LC								√						
38		Perenjak Jawa	*Prinia familiaris* Horsfield, 1821	Bar-winged Prinia		NT			√	√	√									
39		Perenjak padi	*Prinia inornata* Sykes, 1832	Plain Prinia		LC								√						
40		Cinenen Pisang	*Orthotomus sutorius* (Pennant, 1769)	Common Tailorbird		LC			√	√	√	√	√	√	√	√	√	√	√	√
41		Cinenen Jawa	*Orthotomus sepium* Horsfield, 1821	Olive-backed Tailorbird		LC		E	√	√	√	√	√	√			√	√	√	√
42	Muscicapidae	Sikatan Bubik	*Muscicapa dauurica* Pallas, 1811	Asian Brown Flycatcher		LC		M		√										
43	Acanthizidae	Remetuk Laut	*Gerygone sulphurea* Wallace, 1864	Golden-bellied Geryone		LC													√	

No	Famili	Nama Jenis	Nama Ilmiah	Nama Inggris	Permen	IUCN	CITES	Endsm	Lokasi											
									1	2	3	4	5	6	7	8	9	10	11	12
44	Dicaeidae	Cabai Bunga-api	*Dicaeum trigonostigma* (Scopoli, 1786)	Orange-bellied Flowerpecker		LC			√	√	√	√	√	√			√	√	√	√
45		Cabai Jawa	*Dicaeum trochileum* (Sparrman, 1789)	Scarlet-headed Flowerpecker		LC		E	√	√	√	√	√					√	√	√
46	Nectariniidae	Burungmadu Kelapa	*Anthreptes malacensis* (Scopoli, 1786)	Brown-throated Sunbird		LC			√	√	√	√	√	√	√	√	√	√	√	√
47		Burungmadu Sriganti	*Cinnyris jugularis* (Linnaeus, 1766)	Olive-backed Sunbird		LC			√	√	√	√	√	√	√	√	√	√	√	√
48		Burungmadu Sepah-raja	*Aethopyga siparaja* (Raffles, 1822)	Crimson Sunbird	√	LC			√	√										
49		Pijantung Kecil	*Arachnothera longirostra* (Latham, 1790)	Little Spiderhunter		LC				√										
50	Zosteropidae	Kacamata Biasa	*Zosterops palpebrosus* (Temminck, 1824)	Oriental White-eye		LC				√										
51	Estrildidae	Bondol Jawa	*Lonchura leucogastroides* (Horsfield & Moore, 1858)	Javan Munia		LC		E	√	√	√	√	√	√	√	√	√	√	√	√
52		Bondol Peking	*Lonchura punctulata* (Linnaeus, 1758)	Scaly-breasted Munia		LC			√	√	√	√	√	√	√	√	√	√	√	√
53	Ploceidae	Burunggereja Erasia	*Passer montanus* (Linnaeus, 1758)	Eurasian Tree Sparrow		LC			√	√	√	√	√	√	√	√	√	√	√	√
54		Srigunting Kelabu	*Dicrurus leucophaeus* Vieillot, 1817	Ashy Drongo		LC				√										
55	Artamidae	Kekep Babi	*Artamus leucorynchus* (Linnaeus, 1771)	White-breasted Woodswallow		LC								√	√	√	√			
	23 Famili	**Jumlah**			**5**	**LC = 53**	**5**	**E = 4**	**27**	**35**	**22**	**21**	**24**	**21**	**16**	**17**	**20**	**17**	**18**	
						NT = 2		**M = 4**												

Sumber : Data Primer, 2020

Keterangan:

Status Konservasi:

- Peraturan Menteri Lingkungan Hidup dan Kehutanan Republik Indonesia Nomor P.106/MENLHK/SETJEN/KUM.1/6/2018 Tentang Perubahan Kedua atas Peraturan Menteri Lingkungan Hidup dan Kehutanan Nomor P.20/MENLHK/SETJEN/KUM.1/6/2018 Tentang Jenis Tumbuhan dan Satwa yang Dilindungi.
- Status Konservasi dunia - IUCN (*International Union of Conservation of Nature*): NT: near threatened; EN: Endangered ; VU: Vulnerable ; LC: Least Concern, DD: Data Deficient
- Status perdagangan jenis terancam - CITES (*Convention on International Trade in Endangered Species*); Status I = Appendix I; Status II = Appendix II; Status III = Appendix III
- Status Endemisitas ; E = Endemik, M = Migran

Table A9. Aquatic biota in UCPS Area

No.	Local Name	Species	Utilization	Protection Status	Migratory	Note
1	Hampal/hampala	*Hampala macrolepidota*	Food	NE	Potamodromous	N
2	Beunteur/common carp	*Puntius binotatus*		NE	Potamodromous	N
3	Impun/guppy	*Poecilia reticulata*		NE	non-migratory	E
4	Impun paris/platyfish	*Xyphophorus maculatus*		NE	non-migratory	E
5	Nila/Nile tilapia	*Oreochromis niloticus*	Food	NE	Potamodromous	E,I
6	Mas/carp	*Cyprinus carpio*	Food	DD	Potamodromous	E
7	Mujair/Tilapia	*Oreochromis mossambicus*	Food	NE	amphidromous	E
8	Bogo	*Channa gachua*		NE	Potamodromous	E
9	Lele dumbo/catfish	*Clarias gariepinus*	Food	NE	Potamodromous	N
10	Genggehek	*Mystacoleucus sp.*		NE	Potamodromous	N
11	Kehkel	*Glypthothorax sp.*		NE	Potamodromous	N
12	Parai	*Puntius sp.*				
13	Kancra	*Tor douronesis*	Food	BE	Potamodromous	N
14	Senggal	*Macrones nemurus*				N
15	Arelot	*Macrognathus circumcintus*				
16	Cecere	*Aplocheilus panchax (F. Hamilton, 1822)*				
17	Jeler	*Nemachellus fasciatus*		NE	Potamodromous	

DD=Data deficiency, N=Native, E=Exotic, I=Invasive

APPENDIX G. DRAFT TOR FOR ENVIRONMENTAL AND SOCIAL PANEL

PT. PLN (PERSERO)

UPPER CISOKAN HYDROPOWER PROJECT

TERMS OF REFERENCE (TOR) FOR THE ENVIRONMENTAL AND SOCIAL PANEL OF EXPERTS (ESP)

UCPS Project Overview

To be completed:

Provide a summary of the UCPS project in the context of the WB Project (Component 1 and 2).

Note that it is prepared under the World Bank Environmental and Social Framework and the Environmental and Social Standards (ESS).

Program of activities (what has been completed to date, what are the next steps, what activities are in the scope of work for the WB funded Project)

The Project supports the development, construction, and commissioning of Upper Cisokan Pumped Storage (UCPS) with an expected total generating capacity of 1,040 MW. UCPS activities include upper and lower dams, waterways, underground powerhouse, intakes, outlets, electro-mechanical equipment, switch-yard, 2 transmission lines and Supervision Consultant.

UCPS is located in West Bandung & Cianjur Regency, 150 km south east of Jakarta, 30 km west of Bandung City. The lower reservoir will be on the Cisokan River, a branch of Citarum River, while the upper reservoir will be on Cirumanis River, a tributary of the Cisokan River. Cisokan River flows south to north as major tributary of Citarum River, which flows to Java Sea. Several hydropower schemes on Citarum River include Cirata (+/- 35 km downstream, 1,000 MW) and Saguling (neighboring catchment, +/- 40 km away, 700 MW). Cihea irrigation scheme draws water from Cisokan River 3 km downstream. Climate at UCPS is wet tropical with 1 dry and 1 wet season and influenced by monsoon. Area is covered by alluvial & young volcanic sediment with elevation of 400 to 1,000 meters.

Existing land cover consists predominantly of rice fields, mixed gardens, productive forest (pine, abbizia, hindi teak & callandia) and pockets of modified tropical forest. Natural tropical forest (located east of Cisokan River the Project) that will not be directly impacted by inundation. Forest habitat in the UCPS project area is modified by human habitation & agriculture, yet has been confirmed as Critical Habitat under ESS6 and is home to the Critically Endangered Pangolin and Javan Slow Loris, Endangered Javan Gibbon and Grizzled Leaf Monkey, and the Javan Leopard (until recently Critically Endangered but currently not assessed under the IUCN Red List). Small areas of 'biodiversity important areas' have been identified within the modified landscape, where these species have been located. With intense support & close supervision from Bank, biodiversity assessments were completed and a Biodiversity Management Plan (BMP) was prepared by PLN in 2014-2017. PLN started to implement the BMP, most notably by forming partnership with state-owned forestry company Perhutani to protect & enhance existing vegetation cover, forest & wildlife corridors. But deforestation and degradation has continued in the area since 2015 until 2019.

The project area covers 7 sub districts in West Bandung District and Cianjur District. The population is spread across the villages (hamlets) and includes small village families and communities with strong kinship and traditional attitudes and culture. People live according to Islamic values and Sundanese culture. Islam and religious leaders strongly influence their daily activities. The village has a decisive role in decision making, problem-solving and village development. Men are considered the 'head of the household' and are the primary breadwinners and decision-makers. At the same time, women manage household and family affairs, as well as carry out planting and harvesting activities. Education levels are low in all regions, and almost all communities have only received primary school education. The ESIA has confirmed that there is no presence of indigenous peoples, as defined under ESS7, in the UCPS project area.

Agriculture remains the dominant economic activity for local population. The top three livelihood activities are in farming, trading and working as laborers. The primary source of income comes from agriculture and the majority of family labors are owner farmers or farm laborers. They are also doing various odd jobs during low agriculture seasons to supplement family income. Studies under the project indicate that, with various employment opportunities created under the project so far, these is already a general trend in employment among local communities shifting gradually from farm to non-farm sectors.

The environmental risk rating is high. Potential environmental impacts of UCPS are wide range, significant & adverse. Permanent change in hydrological regime & land use, dam safety risk, occupational & community health & safety risks make some of residual impacts long term, permanent & irreversible. Specific mitigation measures for UCPS (the integrated catchment management approach in BMP & FPF) are complex & require specific expertise for its implementation which needs to be built through project implementation. Key environmental risks & impacts: a) potential loss of habitats & loss of key species of conservation concern; b) temporary downstream river impacts (sediment discharge from construction affecting water quality & stream bed patterns); c) minor changes in hydrological regime in Cirumamis & Cisokan Rivers; d) long term changes to erosion & deposition patterns downstream Cisokan River due to reduced sediment load during operation; e) construction work will bring potentially significant negative impacts on communities (sediment runoff, fugitive dust, increased noise, increased traffic, pedestrian & road safety risks, & increased wastes from construction camps); f) dam safety risk to life, property, & ecosystem services.

The social risk rating is high. The construction of UCPS scheme will have significant social risks and impacts. These are related to land acquisition, relocation, labor, gender, Sexual Exploitation and Abuse/ Sexual Harassment (SEA/SH), public health and safety issues, as well as restriction of access to natural resources under the BMP program. The UCPS requires approximately 731,76 ha of land for the construction of two dams, 27km new access road (already constructed), creation of the upper and lower reservoirs, and transmission line. This would lead to loss of various categories of land, residential and other structures, loss and damage to public infrastructure such as school, mosques, water facilities, roads, bridges, sewage and water systems etc. The total number of households affected by land acquisition was 2,063 including 765 households who have to relocate. Three Land Acquisition Resettlement Action Plans were prepared and implemented under the previous World Bank loan. For the new project, PLN engaged a team of independent consultants and carried out a review of the LARAPs implementation progress. This review has identified a number of outstanding tasks and issues that need to be completed. Detailed planning will be carried out and a timebound action plan will be developed and implemented. It is also anticipated that additional land acquisition may be required for contractor construction operations. The UCPS is anticipated to employ approximately 2,700 workers during the peak period of construction. Additionally there will be other people who are expected to move into the project area for business and job opportunities. It is difficult to estimate the size of this migrant population at this moment, but it could be between 4,500-6,000 people at peak period. This large labor influx into the project area could bring along a series of social risks and impacts related to working conditions, occupational health and safety, community health and safety, child labor, SEA/SH and possible social conflict issues and others. Some cultural assets were identified in the UCPS area, including grave, mosques and sacred sites. The project has relocated the graves and rebuilt the mosques under the LARAP, while the sacred area is protected by adjusting project design. During the construction phase, there is a likelihood that there may be chance finds of other cultural assets and properties. The BMP program will have impacts on community access to natural resources in the local forest areas. This impact has been assessed and a Forestry Partnership Program has been design in consultation with relevant forestry agencies and local communities.

Overview of PLN and implementation arrangements (UIP, UPK, Supervisino Engineer/PLN-E/ Engineering Consultant, Dam Safety Panel of Experts)

Environmental and Social Risk Assessment and Instruments

Summary of the key risks and outputs of the ESIA, ESMP etc.

List of instruments (and links to them):

ESIA

ESMP

BMP

SCMP

LARAP

LARF

FPF

Plus supporting information:

LARAP Review

BMP Review

Etc.

Environmental and Social Panel

In accordance with the World Bank ESS1 PLN are required to engage a panel to provide timely, independent, expert advice on the implementation of environmental and social risk management measures for the pre-construction, construction, de-moblisation and commissioning of the UCPS scheme.

Key tasks:

1) Advise PLN on the implementation of the Project environmental and social risk management instruments including actions for the development of systems, procedures, resources and other measures to improve capacity within PLN.
2) Review new or updated management plans, frameworks and other technical documentation prepared by PLN and their technical consultants and provide independent quality assurance advice on the adequacy and accuracy of the content. Prepare written responses.
3) Review TOR for environmental and social assessments, management plans, field work, technical advisory services etc. and provide written comment.
4) Provide periodic (at least six monthly) review of the stakeholder engagement and influx management actions and grievance mechanism and provide independent advice to improve on engagement, disclosure and grievance management and social risk management processes.
5) Provide specific advice on the BMP and FPF as to whether the proposed restoration of habitat is feasible and can be reasonable expected to result in a sustainable 'net gain' of biodiversity values (as per ESS6).
6) Review technical outputs from the design engineers and contractors and advise PLN on the potential for environmental, social, security, health and / or safety risks.
7) Attend workshops, meetings, missions and field visits (including virtually) at key milestones and / or to review progress. This may include preparing and delivering presentations or preparing reports in advance or following the event.
8) Provide independent advice to PLN following a serious harm incident.
9) Provide advice regarding measures to enhance the overall environmental and social outcome of the Project. This will include providing advice and guidance for unanticipated environmental or social impacts of the project that may happen during the construction phase.

Linkages to other independent advisory panels and teams:

Separately a Dam Safety Panel of Experts will be engaged to convene regularly and provide technical review and advisory services for the dam safety aspects of the project, in accordance with ESS4 Community Health and Safety.

Expertise Required

The panel will be made up of at least three members as follows:

Environmental Specialist: Qualified to Masters level or equivalent in environmental science, biology, geography, engineering, ecology or similar. At least fifteen years experience in the assessment of environmental risks and impacts at an international level of expertise (World Bank ESF, Safeguards Policies or equivalent) related to infrastructure development on, near or in rivers, such as dams, hydropower and roads. Demonstrable project experience in Indonesia or similar environments. At least three years' experience supervising or monitoring environmental impacts from the construction of infrastructure including experience in the management of compliance, enforcement, incidents and emergencies.

Social Specialist: Qualified to Masters level or equivalent in social science, anthropology, geography, planning, law or similar, related to social assessment. At least fifteen years experience in the assessment of social risks and impacts at an international level of expertise (World Bank ESF, Safeguards Policies or equivalent) related to infrastructure development with large scale resettlement and livelihood restoration. Experience in hydropower projects and / or community forestry programmes is desirable. At least ten years' experience implementing, supervising or monitoring land acquisition and stakeholder engagement processes. Demonstrable recent (last ten years) experience in Indonesia for land acquisition, social assessment and stakeholder engagement.

Biodiversity Specialist: Qualified to Masters level or equivalent in zoology, biology, ecology or similar. Over 15 years experience in the field of conservation of one or more mammal species in the list of UCPS species of interest and / or the restoration of tropical forest habitat on which they depend. Demonstrable experience in the past five years of panel membership(s), board membership(s), peer review or other governance positions. Recent (past five years) experience working on the biodiversity risks of infrastructure projects is desirable.

The panel will be operational for the duration of the Project (seven years) and must have at least one environmental, one social and one biodiversity expert engaged at all times.

Commitment

This contract is for initial period of two years. Contracts may be renewed on an annual basis following the two-year period by mutual agreement.

Panel members are expected to be available on an ad hoc basis for up to 40 working days per year. The work will be a combination of home office and field based. Pending COVID-19 travel restrictions, the panel is expected to travel to Bandung and to the project site, at least twice a year. This will be at the request of PLN and may align with key project milestones and / or World Bank missions. Panel members must be fit and able to travel and must be familiar with working in remote tropical environments. all other meetings, communications, document reviews and report preparation will be undertaken remotely from the home office. The panel members are expected to have the skills and technology to conduct video-conferencing and file sharing.

APPENDIX H. PHYSICAL CULTURAL RESOURCES SURVEY

PLN