REPUBLIC OF THE PHILIPPINES
METROPOLITAN WATERWORKS AND SEWERAGE SYSTEM
CORPORATE OFFICE

NEW CENTENNIAL WATER SOURCE-KALIWA DAM PROJECT (NCWS-Kaliwa Dam Project)

EIS SUMMARY FOR THE PUBLIC

(September 2019)

ENGLISH VERSION

1 EXECUTIVE SUMMARY

1.1 PROJECT FACT SHEET

Project Name:	New Centennial Water Source – Kaliwa Dam Project (NCWS-KDP)
Description:	Design and construction of a 60-meters high dam and a 27.70 kilometer raw water conveyance tunnel
Objective:	Redundancy of water source and augmentation of water supply to meet increasing demand
Benefits:	Additional water supply of 600 million liters per day (600 MLD)
Location:	Barangay Pagsangahan, General Nakar and Barangay Magsaysay, Infanta, both in Quezon Province
Approvals:	NEDA Board approval on 29 May 2014 NEDA Board approval on 27 June 2017 on the change of project financing from PPP to ODA
Cost Estimate:	Php 12.2 Billion
Funding Source:	Official Development Assistance (ODA) – China Loan
Proposed Construction Schedule:	2019 – 2024 (5 years)
Project Proponent:	Metropolitan Waterworks and Sewerage System (MWSS)
Address:	489 Katipunan Road, Balara, Quezon City, Philippines
Authorized Representative:	PDDG Reynaldo V. Velasco (Ret.), Administrator
Contact Details:	Telephone number: +632 922 3757, 922 2969 Fax number: +632 921 2887 Website: www.mwss.gov.ph Email address: info@mwss.gov.ph
EIA Preparer:	JV EIA Team

The New Centennial Water Source – Kaliwa Dam Project was identified as part of the water source augmentation measures under the Metro Manila Water Security Plan (MWSS, The World Bank, 2012) and was originally a PPP Project launched in 2013. It is now being implemented through ODA, with China Eximbank, under a Design Build Contract with CEEC as D&B Contractor. This project is for the national government to provide redundancy of water source and augmentation of water supply in order to meet the increasing demand in Metro Manila and neighboring vicinities.

The KDP will provide for the construction of a concrete gravity dam along the Kaliwa River with a dam height of 60 meters referred to a riverbed elevation of 100 meters. It will cover a reservoir surface area of 291 hectares with a gross reservoir volume of 57 million m3 at full supply level. It will also entail the construction of the following:

- A spillway at the right bank of Kaliwa River at elevation: 160+ meters.
- Diversion Tunnel: Two (2) at left abutment area of proposed dam
- Conveyance Tunnel: Length is 27.7 kilometers starting at invert level 120+ meters and ends at a level of 95+ meters with a tunnel diameter of four (4) meters.

The maximum required flow is 2,400 MLD or 27.78 m3/sec.

The Water Treatment Plants is not part of the New Centennial Water Source Kaliwa Project as this Project only covers the Dam and Reservoir and the Raw Water Conveyance System (Tunnel, Portal and Stilling Basin). The two (2) WTPs will be the responsibility of the two (2) concessionaires, Manila Water and Maynilad.

1.2 PROCESS DOCUMENTATION

The environmental impact assessment was undertaken based on the Procedural Manual for DENR Administrative Order No. 30 Series of 2003 (DAO 03-30) for the proposed project. The resulting study was documented in the form of an Environmental Impact Statement (EIS) Report. Minimum required by DENR-EMB for the issuance of an Environmental Compliance Certificate (ECC) will be a detailed EIS. The EIS as outlined in the revised procedural manual was used as basis in the conduct of this study.

The result of the EIS shall be used by the proponent as a tool in the formulation of appropriate environmental management plan for the proposed project.

1.3 EIS TEAM

The EIA Team is composed of multi-disciplinary specialists with expertise in the conduct of Environmental Impact Assessment, EIS and other environmental studies. The following are the team composition.

Consultant	Specialization
Noel M. Ortigas	Team Leader
Carolyn DP. Barrias	Environmental Specialist
Benigno V. Resurreccion	Environmental Specialist
Verda I. Saw	Sociologist
Erlinda Isla	RAP Specialist
Bonifacio Pasion	Terrestrial Flora Specialist/Biomass Expert
Abelardo Angadol Jr.	Terrestrial Fauna Specialist
Ricardo Capule	Air and Noise Quality Specialist
Leandro R. Agudo	Geologist
Franklin S. Morales	Hydrologist
Robert R. Pabiling	Freshwater Specialist

1.4 EIS STUDY SCHEDULE

The team was assigned to conduct the EIS study from February 2019 to April 2019. Public Consultations with Municipalities and Barangay Scopings were held on March 2019 and April 2019.

Ocular inspection of the area to determine the exact location of the project site, to establish the primary and secondary impact areas, the existing land uses, the receiving body of water, ecological characteristics, geophysical feature, etc.
Both primary and secondary were collected and used in the environmental examination and assessment of impacts of the project. Different methods were used in gathering primary and secondary data:

- Meeting with the proponent and extensive discussion on the description of the project
- Technical Scoping and Public Consultations
- Gathering and review of secondary data from proponent, private and concern government offices.
- Actual site investigation, focus group discussion and consultative meetings
- Mapping using GPS, compass, topographic and google maps
- Actual flora and fauna survey
- Actual investigation of socio-economic profile and gathering and review of secondary data

1.5 EIS STUDY AREA

The scope of the study focuses on the probable adverse impact that may occur during the operation phase of the project on water, air, soil, health, people and the environment in general. The impact prediction is based on similar, past actual eventuality and perceptions based on the present physical condition of the environment.

An environmental study area (ESA) was delineated corresponding to the Direct Impact Area (DIA) and the Secondary Impact Area (SIA).

The entire Kaliwa River Watershed, from its confluence with Kanan (where they become Agos River all the way downstream) is 37,174 hectares. A total of 9,318 hectares comprises the proposed Kaliwa Dam site upstream.
The DIA corresponds to the dam/reservoir structure sites including the conveyance tunnel route alignment which is approximately 2,000 hectares. The SIA corresponds to the watershed of Kaliwa River. The SIA also includes the valley section of Kaliwa River from the outlet of the diversion tunnel to the mouth of the Agos River in Infanta, Quezon.

The Regional Impact Area (RIA) generally covers Metro Manila including Rizal and Cavite, which are the potential beneficiaries of water distribution and the provinces of Quezon and Rizal.

The table below shows the location of each project structure and its impact area category.

	Province/Municipality	Location of Project Structures	Impact Area Category*
A	**RIZAL**		
	1. Tanay		
	>Daraitan	Fringes of reservoir area to occupy portion of Tinipak	DIA
	>Cayumbay, San Andres, Sampaloc	Water conveyance facility/tunneling area	DIA
	>So. Pantay, Buhangin Dalig, Teresa, Sampaloc	Conveyance tunnel (outlet)	DIA

	Province/Municipality	Location of Project Structures	Impact Area Category*
	>Watershed area	part of the Protected Area under PD 1636 and CADT	SIA
B	**QUEZON**		
	1. General Nakar		
	>Pagsangahan	Dam and reservoir area; diversion tunnel	DIA
	>Watershed area	Part of the Protected Area under PD 1636 and CADT	SIA
	>Town proper	Flooding/disaster risk area	SIA
	2. Infanta		
	>Magsaysay	Dam and reservoir area; spillway and intake area	DIA
	>Watershed area	part of the Protected Area under PD 1636	SIA
	>Town proper	Flooding/disaster risk area	SIA

* DIA refers to the direct impact area and SIA to secondary impact area

1.6 EIA METHODOLOGY

Scoping with DENR is usually done to define the range of actions, alternatives, and impacts that are to be examined. The presented outline prepared by DENR in the Revised Procedural Manual for DAO 03-30 was used as basis to determine the actual scope of this study. Table below presents the different components and methodologies of the project.

Study Module	Scope and Coverage	Method of Data Gathering	Location and Size of Study Area	Method of Assessment
Socioeconomics	Demographic profiles Regional/local economy Livelihood Employment Income levels IP, culture and lifestyles Social services and infrastructure Social organizations Social benefits Social issues/ concerns	Key informant interviews / focus group discussions Socioeconomic survey (SES) Informal consultations Secondary data Perception survey Unstructured group interviews Site observations	Direct impact area Secondary impact area Regional impact area	Quantitative and qualitative analysis of secondary data and information gathered from consultations and interviews; process evaluation; analysis of SES and perception survey results; anthropological observations
Air/Noise Quality	Air quality (SPM, SO2, NO2) Background meteorology Noise levels	Air and noise sampling; secondary meteorological data	Direct and Secondary impact area	Laboratory analysis of air samples and comparison with DENR air quality standards; noise level readings and interpretation; analysis of area

Study Module	Scope and Coverage	Method of Data Gathering	Location and Size of Study Area	Method of Assessment
				sources of emissions
Soils, Land Use and Watershed Management	Vegetation and land use Soil profile and their properties Slope Erosion susceptibility Agriculture Kaliwa Dam watershed	Site reconnaissance Review of secondary data Auger borings and dug pits Soil sampling Informal interviews	Direct, Secondary and Regional impact area	Landsat imagery interpretation; mapping of soil units, land use, vegetation, slope and erosion; analysis of soil sampling results; analysis of existing agricultural practices; determination of extent of erosion susceptibility
Water Quality	Physico-chemical parameters of surface waters– Class A/DAO 2016-08 Beneficial water uses	river water quality sampling (TSS/TDS, DO, BOD, coliform, pesticides, nitrate, phosphate, sulfate)	Kaliwa River	Laboratory analysis of water samples; comparison of results with river water quality standards for beneficial water uses in the areas
Terrestrial Vegetation and Wildlife	Species composition and biodiversity assessment Profiling of vegetation and wildlife Characterization of various ecosystem types	Informal interviews Ethnobiological survey Transect walks Secondary data General field observations Species inventory	Direct Impact Area	Species composition vis-à-vis species diversity, endemism and conservation status for wildlife; Establishing the degree of disturbance and species abundance for vegetation
Risk Assessment	Risks associated with the construction and operation of the Kaliwa Dam and Reservoir	Secondary data Field observations Review of geology and hydrology modules	Direct Impact Area and Secondary Impact Area	Analysis of secondary data vis-à-vis proposed structures and geological profile of the area; mapping interpretation
Geology and Hazards	Regional and local geology Geologic hazards Geomorphology Lithology Seismicity Engineering geology	Regional mapping, Field observations and actual field traverses Secondary data	Environmental study area; regional geological setting	Analysis of primary and secondary data; identification of hazards; assessment of the engineering

Study Module	Scope and Coverage	Method of Data Gathering	Location and Size of Study Area	Method of Assessment
				geology of the structure sites
Hydrology	Climate/rainfall patterns (long-term) River discharge Flood flow analysis Water balance	Secondary data Ocular inspection Flow measurements	Direct Impact Area and Secondary Impact Area	Water balance analysis using the NHRC Watershed Hydrologic Model; flood analysis utilizing USACE HEC-RAS model
Aquatic Ecology	Plankton Macrobenthos Species composition and ecological status Fishery and other aquatic resources	Key informant interviews Fish collection and identification Plankton/macro-invertebrate sampling Secondary data	Direct Impact Area	Quantitative and qualitative analysis of data gathered from sampling/ collection and interviews; determination of important species; analysis of project implications on aquatic life

1.7 SUMMARY OF PUBLIC PARTICIPATION

Apparently, majority of the affected people were aware of the Kaliwa project for quite sometimes, but their knowledge of the project is tied up with the Laiban Dam project originally planned in the area and the present issue they have in the Umiray Project. However, when given the right information about the project and provide them with regular venue to raise their issues and concerns, their acceptance of the project will not be difficult to obtain.

The results of the focus group discussions and individual interviews of the affected people and the chieftains revealed that their opposition to the project is centered on losing their homes and livelihood opportunities. They have resigned themselves that the government has the right to take over their lands, but they also expect to be justly compensated for their vegetation which has become their source of income and daily food consumption. Although there are a few hard-core oppositionists including some politicians using the issue as their campaign slogan, majority are still willing to listen and open for negotiation.

The issues and concerns raised during the public scoping meetings and focus group discussion on the Kaliwa Dam Project are summarized as follows:

From the IP stakeholders (on compensatory mechanisms to affected families):

- Loss of sacred burial sites, fishing and hunting grounds for IPs which have significant cultural value to them and as sources of their livelihood. There is fear that there will be nothing left for the future generation of IPs for life and survival.
- IP customary laws and NCIP guidelines pertinent to consultations prior to studies and FPIC should be respected and not bypassed by MWSS. Also related to this is the issue

on transparency and right to be informed of the status of the project including the result of the EIA; consultation should not only be at the start but up to the end.

- Before embarking on the Kaliwa Dam Project, MWSS should first settle its obligations to the people of General Nakar (mostly IPs) on the Umiray Transbasin Project to show its sincerity in fulfilling its commitment to the people in the area; disappointment on MWSS had been raised because of alleged non-payment of compensation of affected families in said project.
- Benefits that should accrue to the IPs and other affected persons should be clearly laid out within a given time frame and should include compensatory schemes in form of education, livelihood, relocation and others. This should be fulfilled to show that MWSS is sincere and take them seriously.

From water users/watershed stakeholders in the SIA (on water use conflicts and watershed management):

- Why not explore and/or harness other alternative sources of water like the existing Wawa Dam or why not tap other options outside of the planned NCWSP as the solution to the problem of Metro Manila.
- Issue of compromising the water security of Infanta. It also needs water for irrigation and domestic use not just Metro Manila. Infanta taps ground water for its domestic water needs. If the dam pushes through, the supply of water from Agos River could be affected and could in turn affect groundwater availability over time. Indications of decreasing water availability are now being experienced.
- Irrigation system in Infanta, where General Nakar source its rice and the rice basket of Quezon province, could be affected and could also affect the planned irrigation system in Nakar (which would irrigate some 500 ha of agricultural land).
- How much water would be left to the SIA if the project is implemented
- The long-term thrust for water security is watershed management not construction of dams.
- The good side of the project is it can arrest or combat illegal activities in the forest especially logging. The massive flooding experienced in 2004 is a result of the destruction of the watershed as there were no dams yet at that time.
- Construction of dam will not solve the logging problem, deprivation of water for the people of Infanta is the issue of which compensatory measures should be laid out to determine what benefits would accrue to the locals in exchange for what they will lose.
- Issue of sustainability of the project given watershed condition and various water use allocation.

From downstream communities in the SIA (on potential risks):

- Perceived high risk involved compared to whatever benefits that would be given. Infanta, which is a catch basin and a flood-hazard zone area, is much concerned about possible releases of water during typhoon events and dam break as it will compromise people's lives and properties including livelihood.

- The project could strengthen and/or build-up the capacity of Infanta for disaster risk preparedness and management.
- Since this is a national project, the question is whether it will be pursued if there is strong opposition from the affected communities.

The issues/concerns generated in the scoping were further reinforced, distilled and particularized during the series of FGD/KI sessions with different stakeholder groups. The same forum was also used to gather additional concerns and explore options and ideas from the stakeholders on how to address them.

The results of the barangay consultations in the DIA as they apply to the Kaliwa Dam are summarized as follows:

a) Resettlement
    - Compensation and entitlements for affected families
    - Assurance of home lots and farm lots for eligible families with appropriate tenurial security
    - 100% full payment of compensation for lost assets, prior to transfer/relocation
    - Assurance of livelihood opportunities for men and women at the relocation site (i.e., farming, livestock raising)
    - Educational assistance/scholarship programs for students
b) Gender Concerns
    - Ensure livelihood opportunities for women (i.e., farming, handicrafts-making, etc.)
    - Ensure access to water for domestic use (i.e., laundry, dish washing, cooking, house cleaning, backyard gardening, etc.)
    - Impact on the role of women in farming activities
c) Indigenous Peoples' concerns
    - Compensation for lost assets
    - Access to land and water/river resources to continue their means of livelihood (i.e., fishing and farming) and other socio-cultural activities should be assured at the relocation site
    - Majority of the IPs are not used to settling together with the lowland residents, and this should be considered in the resettlement plan, if any
    - CADT has recently been awarded; the FPIC process should be respected and adhered to
    - Explore possible watershed co-management arrangement with IPs, which most likely would affect and change their farming practices (i.e., slash and burn method or kaingin)
    - Prioritization of IPs and affected residents in the employment opportunities of the project
    - Benefit-sharing between MWSS and IPs
    - IP representatives should have active participation in the project
d) Environmental impacts

- Exploring possible co-management arrangements with the affected barangays, especially with peoples' organizations engaged in watershed management
- Implications on DENR's national greening program in the area

e) Environmental concerns
- There are a number of potential eco-tourism sites within the area (i.e., falls, caves)
- The initial partnerships forged with the private sectors will be affected

f) Benefit-sharing
- Benefit-sharing arrangement between MWSS and the affected barangays

g) Legal
- Complex land ownership arrangements (i.e., 'rights' arrangement through Barangay Certification, possibly covered under ancestral domain land or timberland or Kaliwa Watershed reserve, and an overlap of two or three proclamations)

1.8 EIA SUMMARY

1.8.1 Summary of Alternatives

Of all the alternatives for a new major water source of water for Metro Manila and its adjacent provinces, the Kaliwa River through the Kaliwa Dam is the most promising. Kaliwa Dam would maximize supply output but would entail the least habitat disruption and resettlement. It was observed that the development of the Kaliwa Dam is more viable and manageable and can immediately address the projected short-term water supply deficit of Metro Manila in the near future.

The two (2) options that were considered for the Kaliwa Dam before - a temporary dam or a permanent dam. The temporary dam option was considered as an initial development prior to the proposed Agos Dam, which would eventually lead to the submergence of the low dam. The permanent dam option however would play a long-term role in the stream diversion on the Kaliwa River. The latter was opted, and its development is mutually exclusive of the Agos Dam.

Several alternative options for dam configurations were determined for the Kaliwa Dam. After careful consideration and discussion with MWSS, the Kaliwa Dam configuration was selected based on the following advantages:

- No flooding of Daraitan due to a designed Full Supply Level (FSL) of 160 meters.
- Kaliwa Dam sufficiently high (60 meters) to minimize risk of significant impact of siltation/sedimentation on the reservoir capacity
- Potential to augment (600 MLD) a possible water supply deficit in Metro Manila and neighboring vicinities by the year 2020

Alternative dam height and dam design options were likewise evaluated for the Kaliwa Dam that would maximize supply output but would entail the least habitat disruption and resettlement. Various types of dams were taken into consideration in the design of the Kaliwa Dam. These

include concrete gravity dam and central-core rock-fill dam with either an asphalt core or a clay core to secure water tightness. Also, a roller compacted concrete (RCC) type of dam was considered. Each of these dam types has its specific characteristics, both advantages and disadvantages.

However, based on the conditions at the proposed site of the Kaliwa Dam, the concrete gravity dam type has been selected due to the abundance of rock in the project site that can be used as a construction material. The dam height of 60 meters referred to a riverbed elevation of 99 meters was found to be the most economically and environmentally viable yielding a gross volume of 57 million m3 at full supply level or a maximum flow of 2,400 MLD or 27.78 m3/sec.

Based on the hydrological data from various studies, it was assessed and concluded that the Kaliwa Dam can deliver the 600 MLD with sufficient reliability. Clearly, it is observed that dam can address the possible water supply deficit in Metro Manila in the year 2020. The design of the dam and conveyance structures was completed based on the basis of the new design configuration and hydrologic assumptions.

The distance of the Kaliwa Dam site from active earthquake generators has made it less susceptible to ground rupture. Based on the regional assessment of the Mines and Geosciences Bureau (MGB), the mountainous terrain where the proposed engineering structure sites will be constructed has a high susceptibility to landslides. A closer assessment indicated that the selected sites for the dam, spillway and tunnels are underlain by competent foundation materials with visually stable slopes. Accordingly, earthquake-induced landslides are not likely to occur. Geotechnical investigation must be conducted to quantify this assessment. There are no volcanoes within the region which can potentially affect the structure sites via eruption or lahar flows. Being located inland, the project area is not vulnerable to storm surges and tsunamis. Both hazards take place in coastal areas during typhoons and after major seismic events, respectively.

Summary of Baseline Characterization, Key Environmental Impacts and Management and Monitoring Plan

Ecosystem	Integrated Key Findings/Conclusions	Environmental Quality Status
Land	Regionally, the proposed Kaliwa is located within the Southern Sierra Madre sub-province of the Eastern Physiographic Province and on the eastern edge of the Southwest Luzon Highlands. The Island of Luzon where the Kaliwa is to be sited occupies the northern section of the Philippine mobile belt and would thus be potentially affected by major earthquake generators, particularly the Philippine Fault Zone. The sites of the proposed engineering structures are susceptible in varying degrees to the natural processes of erosion, siltation, mass movement,	Geomorphologic processes indicate erosion occurring along exposed areas of higher elevation; scouring along stream and riverbanks and mass movements involving mainly residual and colluvial materials which mantle the slopes. Local slides were noted upstream of the proposed damsite. The Kaliwa Delta and the main channel of Kaliwa River are regularly subjected to flooding of varying degrees and to siltation.

Ecosystem	Integrated Key Findings/Conclusions	Environmental Quality Status
	flooding and seismic related hazards. Earthquakes could bring about ground shaking that could affect the stability of the dam and tunnels. However, they are not susceptible to ground shaking. Four soil types were identified, which are residual in character mainly derived from the weathering of underlying igneous and sedimentary rocks. They have varying degrees of erosion susceptibility with most of those areas under kaingin and mixed shrubs/grasses on shallow soils and above >18% slope exhibiting high susceptibility to erosion. Result of the flora and fauna study revealed that overall, the studied area within Kaliwa watershed and along the conveyance tunnel have considerable flora and fauna biodiversity. However, plot-level biodiversity was relatively low, which can be due to open ecosystems mostly covered in the study. Despite this, there are number of key important species recorded. Relative to the presented result of terrestrial flora and fauna survey, it is necessary to consider during the detailed planning design of the project the inclusion of the recommended mitigating measures to minimize project impacts to flora and fauna and in the surrounding environment. Further, this information could also assist in the conduct of further studies on how we could effectively and sustainably manage and/or improve the ecosystems in the project area. The Kaliwa watershed supports a variety of wildlife, most of which are common resident/native and endemic species closely associated with an agricultural area with forest remnants. Species diversity of birds range from moderate to high with 11 noteworthy species identified based on endemicity and conservation status. The watershed area of the Kaliwa covers around 9,318.3 hectares within the municipalities of Tanay, Rizal and General Nakar, Quezon. The downstream SIA corresponds to the barangays of General Nakar along the confluence of Kaliwa and Kanan rivers on to the Agos river which meanders through the entire stretch of Infanta up to the coastal areas along the Pacific Ocean. Portions of the project area lies within the ancestral domain (AD) of the Dumagat-	Vegetation is largely characteristic of an agroecosystem landscape dominated by cultivated agricultural crops with remnants of natural forests along the steep slopes of the river. Vegetation and wildlife reflect the current state of watershed disturbance/deterioration but still exhibit high plant diversity especially along the riparian zone. Present wildlife generally concurs with the present habitat type.

Ecosystem	Integrated Key Findings/Conclusions	Environmental Quality Status
	Remontado IPs covered by two Certificate of Ancestral Domain Title (CADT) proclamations and thus governed by the IPRA law (RA 8371). Encompassed by the ADs are the Kaliwa Watershed and its river systems with several identified sacred sites where they source their drinking water, lead the sick to be healed, conduct baptismal rites and rituals and bury their dead	
Water	Long-term monthly and annual climatic water balance computations confirm that the area has a positive net rainfall or water surplus during the whole year. The 80% dependable flow is equivalent to about 800MLD. The water quality sampling in 4 selected river stations representing the dry season condition for physico-chemical parameters show that all are within the Class A standards. DO levels are high while BOD levels in all stations are low indicating a well aerated and unpolluted river waters. Bacteriological analysis, however, showed that total and fecal coliform levels in the midstream and downstream stations did not conform to the standards for Class A waters. These suggest that the river is being used by some households for sewage disposal and/or animal feces noting the presence of a small community in the area and domestic animals.	The estimated minimum flow is equivalent to 124 MLD, which means that the minimum environmental flow of 80 MLD is exceeded all the time under existing stream flow conditions. Water quality in general conforms to class A waters but presence of coliform bacteria indicates that pathogenic microorganisms might pose a health risk, especially if water is to be used for human consumption. Aquatic flora and fauna reflective of good water quality and suitability for survival of aquatic life.
Air	Results of air quality for all parameters measured at six (6) sites are compared with National Ambient Air Quality Guideline Values (NAAQGV) of Republic Act 8749 or known as Philippine Clean Air Act. All parameters tested are within the allowable limits except for the SO2 (µg/Ncm) at ASS5.	Air quality within DENR standards except for SO2 at ASS5; noise level exceeded the limit for residential areas along the sampling sites due to sound system, constant vehicle traffic at the road nearby, dogs, roosters, videoke and from residential area.
People	The host LGUs of the Kaliwa Dam are mostly categorized as first class in terms of income but still retain a large proportion of rural areas with economic base anchored mainly on agriculture and fishery. The DIA is more rural, largely inaccessible and sparsely populated. The PSA 2015 Census reflects the household monthly income. A significant majority (53%) have a monthly income of Php 5,000 and below. Following the Region IV-A poverty statistics figures, the annual per capita poverty threshold	There are several families that would be likely affected by the project. These families are typical of rural poor communities subsisting on agriculture (largely kaingin farming) and gathering of forest products for livelihood and income. Except for a nearby elementary school, their remote location limits their access to basic social services, which can

Ecosystem	Integrated Key Findings/Conclusions	Environmental Quality Status
	was estimated at P 9,063.75, a month for a family of five, or Php60.43 per day per person which means that a family with an average of five (5) members should have a monthly income of P4,000 to meet basic food and non-food basic needs. A monthly income below Php 4,000 per household is already considered living below the poverty threshold. It was estimated that about 45% of the affected households in Gen. Nakar is considered poor while Magsaysay, Infanta posted an annual income of each household ranging from P5,000.00 to P10,000.00. Portions of the project area lies within the ancestral domain (AD) of the Dumagat-Remontado IPs covered by two Certificate of Ancestral Domain Title (CADT) proclamations and thus governed by the IPRA law (RA 8371).	be reached mainly by foot, horse or via the river.

1.8.2 Summary of Key Impacts and Mitigating Measures

It has been determined that most of the negative impacts will be during construction phase In terms of environmental impacts, the main components that need to be managed are: compensation and relocation of displace residence and structures, dust and noise suppression, traffic management. Positive Impacts is expected during Operation Phase.

Project Phase/Envtl Aspect	Environmental Component/Degree of Impact	Mitigation/Enhancement Measure
Pre-Construction/ Construction	**The Land/Water**	
	Terrain modification, soil displacement, and erosion (+S)	Formulation, implementation and strict monitoring of materials mgt. Scheduling of earthworks, whenever possible during the dry season Identification of appropriate sites for placement of excavated materials Possible use of excavated materials as part of foundation of structures where design allows Immediate revegetation of exposed areas not allocated for engineering structures Use of silt ponds or traps around work areas; monitoring Excavated materials can be reused by the LGUs in other construction projects upon their request
	Impacts on Land Use	Close coordination with LGU for land use planning Strict adherence to the zoning in the area Immediately Restore the adjacent areas temporarily use
	Encroachment to ECA	Ensure compatibility of management plan to the existing management plans under proclamations

Project Phase/Envtl Aspect	Environmental Component/Degree of Impact	Mitigation/Enhancement Measure
	Impairment of visual aesthetics	Engineering solutions will be proposed and implemented to not affect or lessen the effect of the project unto Tinipak and other tourist/sacred sites.
	Slope destabilization (MS)	Conduct extensive geologic and geotechnical studies of structure sites Slope stability analysis inputted into design Deployment of experienced engineering geologist or geotechnical engineer at site Use of appropriate slope stability measures such as rock bolts, shotcreting, etc.
	Mobilization of construction equipment and workers which will require vegetation clearing to facilitate movement.	Laying the road networks on areas without forest cover or areas with minimal forest cover Identification and marking of ecologically/ economically important species If feasible, earth-balling and avoid cutting ecologically important species identified in the area, potential mother trees for these species shall be located and seeds/propagules shall be collected, to serve as genetic source for these important species
	Trampling of understorey vegetation Clearing of vegetation growing in the proposed access road	Avoidance of unnecessary clearing Localized movement of equipment and personnel Vegetation to be cleared should be properly delineated to avoid unnecessary clearing
	Increase in noise level, generation of suspended particulates and gaseous emissions (MS)	Scheduling of earthmoving and construction activities during daytime Sprinkling of water stockpiles of excavated and construction materials Proper materials handling; installation of mufflers for vehicles Provision of protective gear for workers; monitoring
	Deterioration of river water quality (MS)	Proper materials handling; monitoring Strict enforcement of solid and liquid management at the construction site
	Increase in solid waste generation (MS)	Strict enforcement of solid and liquid management at the construction site Provision of waste bins, regular waste collection and disposal to a sanitary landfill Reuse of construction debris which meets foundation requirements Orientation of construction workers on proper waste management
	Permanent loss, disturbance to existing vegetation (MS)	Identification and marking of ecologically/ economically important species Collection of seeds/propagules of important species for propagation in other areas Delineation of areas for vegetation removal and earthmoving Immediate progressive rehabilitation using appropriate species at cleared areas not designated for engineering structures

Project Phase/Envtl Aspect	Environmental Component/Degree of Impact	Mitigation/Enhancement Measure
		Inclusion of project site in the MWSS Million Tree Challenge Program
	Death, disturbance and displacement of wildlife species; destruction or damage to habitat (MS)	Restoration/rehabilitation of areas at higher elevations Delineation of areas for vegetation removal and earthmoving
	Disturbance of aquatic habitat death or temporary displacement of species (MS)	Erosion control of excavated materials and stockpiles Monitoring; provision of passageways through the structures for migratory species
	Loss of Biomass and Carbon	implementing a forest restoration plan
	Increase in ambient noise level	In order to minimize the abovementioned pollution and harms, control measures may be taken in action: Equipment and machinery in good quality will be purchased and operated, as well as full maintenance, to ensure fuel fully combusted for standard emission. Under the instruction of the Employer's delegated representative, flammable wastes, solid garbage, office and maintenance wastes that need to have combustion treatment will be burned at approved time and place. Watering may be needed for keeping moist to minimize the powders in excavation areas. Transportation vehicles with sideboards will be covered by waterproof tarpaulin when transporting in bulk. All access roads at construction areas will be kept clean and being watered to minimize the dusts when vehicles pass. Much disposal areas will be equipped with watering systems so as to minimize the raise dusts. Watering is also needed when it's windy and gusty. Workmen will wear dustproof masks where dusts are more likely to generate. Dusts reducing system will be installed in areas where dusts and smokes are more likely to generate such as gravel crushing plants, sieving plants and cement filling plants. Regular dusts and powders investigation will be carried out to ensure standard emission is reached as per the laws and regulations of the Philippines Government.
	Increase in ambient noise level	In order to minimize disturbs and hazard of local residents and workmen, control measures will be taken implemented: Relatively fixed locations such as compressor room, framework fabrication plants, concrete batching plants and gravel processing plants will choose to be far away from inhabitants. Noise insulating shelters will be installed to insulate noises from mixers, concrete pumps, electric saws and large compressors. If necessary, sound walls are necessary where construction takes place in residential areas. Noise refresh rooms will be installed for workmen in these areas.

Project Phase/Envtl Aspect	Environmental Component/Degree of Impact	Mitigation/Enhancement Measure
		Mufflered or lower noised equipment and machinery will be used as much as possible. Strict timing will be set when construction takes place nearby inhabitants, no later than 22.00pm and no earlier than 6.00am. Necessary negotiation with local people will be made where construction demands 24 hours shift. Control measures against noise will be carried out as per government laws and regulations. When blasting, amicable communication with local residents is a must. Security will warn unrelated persons to avoid hazard of loud explosion. Daily exposure of one single workman will be controlled under the noise louder than 80 decibels. Workmen in noisy areas will wear ear plugs. Contractors shall be required to ensure that construction equipment and vehicles are in a good state of maintenance. Workers are required to wear Personal Protective Equipment such as earplugs or earmuff during activities that have impact on noise like drillings.
	The People	
	Loss of land/farm area, properties, crops and community facilities including traditional access to these areas and attendant dislocation and loss of income due to ROW acquisition (MS)	Continuing IEC/consultations to update status of RAP and negotiate with remaining AF/IPs on relocation, valuation and compensation based on RAP review. Secure FPIC for IP-specific RAP concerns Active and full coordination with the National Commission on Indigenous Peoples (NCIP) Finalize RAP incorporating refinements based on agreements with remaining group (who still have reservations on the compensatory measures proposed)
	Increase in employment opportunities and benefit sharing (+MS)	Ensure that benefits of employment will accrue to affected groups Consider also other qualified community members, where appropriate to spread the benefits to the community Contractors to orient workers on desirable working relationships especially if there is migrant labor
	Increase in livelihood and business opportunities (+MS)	MWSS to adopt policy requiring as much as possible sourcing or purchase of construction supply requirements from locally available sources within Tanay, General Nakar and Infanta or the province Food requirements of migrant workers/staff to be supplied locally
	Potential health, sanitation and safety problems (NS)	Temporary housing facilities for contractors provided with adequate water and sanitation facilities Contractors to implement proper solid waste management in the work site, workers will be oriented to observe proper hygiene and sanitation practices and provided with appropriate protection gears while working Construction areas to be enclosed as necessary and provided with appropriate signage to avoid accidents from curious residents and workers
	Loss of Navigational Access (MS)	A temporary mooring facility for the rafts and *bangkas* to be installed in the vicinity of the upstream cofferdam. An access road from this point to Sitio Queborosa shall be provided
Operation	**The Land**	

Project Phase/Envtl Aspect	Environmental Component/Degree of Impact	Mitigation/Enhancement Measure
	Submergence of some springs and caves in Daraitan (MS)	Improvement of access/maintenance of remaining caves and springs
	Decrease of flooding of downstream areas (+MS)	Dam will lessen the amount of flood waters that can reach the downstream area
	Disruption of migration pattern of aquatic organisms (MS)	Provision of structures that will allow upstream and downstream movement of migratory aquatic species
	Habitat loss and fragmentation (MS)	Restoration/rehabilitation of areas at higher elevations MOA executed with General Nakar for watershed management. For Infanta, same MOA will be executed
	Large-scale clearing of vegetations that are present within the construction areas	Progressive rehabilitation methods must be done to ensure that no large tracts of land will be devoid of vegetation to minimize microclimate change in the locale Conserve as much forests areas within the project site which is not be intended for development, this could serve as biological corridor and refuge area for the wildlife to be displaced
	Removal of photosynthesizing plants will affect CO2 sequestration causing some degree of effect on the microclimate	Forest rehabilitation will focus on a progressive reforestation program. Progressive means step-by-step reforestation program. This can be done by first planting pioneer species and more light tolerant species to ameliorate soil productivity and initial vegetation cover. Second, the slow growing, light intolerant and climax species can be introduced in the reforestation area as the program progresses.
	Altered movements and dispersal of wildlife, and invasion of non-native and degraded habitat-associated species	
	The Water	
	Water use conflict	Formulate water allocation policy to be implemented during temporary drought period under the strict supervision of the National Water Resources Board (NWRB) and coordination with the National Irrigation Administration (NIA) Establish hydrologic monitoring network consisting of rainfall and river gauges and streamflow discharges at the Kaliwa Dam watershed area Watershed management program
	Loss of food source and navigational access from Daraitan to Sitio Queborosa (MS)	Establish permanent mooring facility for bangkas at a safe distance from the dam and spillway. Construct an all-weather road from this point to Sitio Queborosa to complete the Daraitan-Queborosa linkage Put in place navigational safety features and regulations in the vicinity of the diversion tunnel, dam and spillway Provide alternative fishing livelihood outside of the reservoir area
	Increased Water Supply for Metro Manila, Cavite and Rizal (+S)	Implement RAP properly and formulate benefit sharing schemes for the host LGUs so that the benefit will not only accrue to Metro Manila and environs but also to the impacts LGUs and communities; and improve credibility of MWSS thru effective

Project Phase/Envtl Aspect	Environmental Component/Degree of Impact	Mitigation/Enhancement Measure
		communication plan coupled with sustained actions to demonstrate sincerity and commitment to fulfill its obligations to generate goodwill and social acceptability; monitor RAP
	The People	
	Increased employment opportunities (+S)	Sharing of benefits from employment between affected and non-affected groups
	Increased revenues for LGUs (+S)	Use revenue generated from project to improve social services and infrastructures in the DIA
	Increased migration and population (MS)	Concerned LGUs (barangay and municipal/city) to regulate encroachment in watershed areas (forestland) through proper zoning and enforcement in conjunction with the PA Management Plan LGUs to adequately plan/provide for social services and infrastructures including health services, waste management and facilities and road network

1.8.3 Summary of Compliance Monitoring

Project Phase	Parameter	Location	Frequency	Responsibility	Cost (PhP)
Pre-Construction/Construction Phase					
> Right of way acquisition > Site surveys, design > Excavation works > Foundation works > Grading and compaction > Vegetation clearing/cutting	**The Land** Contractor's Material Handling/ Site Protection Program	Construction sites especially for dam, tunnels, spillway	Before construction	MWSS/Contractor	Part of MWSS supervision cost
	Slope profile and signs of instability	Abutments of Kaliwa Dam, tunnel portals, spillway area	2x a week during construction	Construction Contractor	Part of CC Cost
	River water quality-DO, pH, TSS, TDS, BOD, conductivity, total and fecal coliform	Dam site and at least 100 m upstream and downstream of dam site area	Monthly	MMT	P250,000.00/year
	Freshwater Biota Monitoring – Plankton, Macroinvertebrates and Fish – Species Composition and abundances	Dam site and at least 100 m upstream and downstream of dam site area	At least semi-annually (wet and dry season)	MWSS	P250,000.00/year
	On site materials handling	Structure sites	2x a week	MWSS/MMT	Part of CC Cost
	Tree cutting/removal of vegetation	Kaliwa Dam, tunnel intake	Monthly during civil works phase	DENR/MMT	P100,000.00

Project Phase	Parameter	Location	Frequency	Responsibility	Cost (PhP)
		and outlet, spillway area			
	The People				
	RAP implementation	Kaliwa Dam and reservoir	Before relocation	MMT	P100,000.00
	Local employment	DIA-wide focused on downstream areas	Quarterly	MWSS/MMT	P50,000.00
Operation and Maintenance Phase					
> Dam operation > Treatment facility operation	**The Land** Dam stability monitoring parameters and instrumentation: Alignment (Total station, GPS, laser) Rotation (Inclinometer, tilt meter) Differential movement (Strain gage, extensometer, tilt meter) Water pressure (Piezometer, pressure gauge, observation well) Stress and strain (Total pressure cell, strain meter) Internal temperature (Thermocouple, thermistor) Seepage quantity (Weir, flume, flow meter, calibrated container) Seepage quality (Turbidity meter) Anchor load retention (Load cell, jack and pressure gage) Earthquake response (Strong motion accelerometer)	Kaliwa Dam, spillway area	Daily	MWSS/Dam operator	Part of O & M cost

Project Phase	Parameter	Location	Frequency	Responsibility	Cost (PhP)
	River water quality - pH, DO, BOD, TSS/TDS, Total/fecal coliform, NPK and pesticides, heavy metal	Reservoir area	Monthly	MWSS/Dam operator	P250,000.00/year
	Area reforested/covered and % of survival	Kaliwa Dam area	Annually	DENR/MMT	Part of Watershed Management Program
	The People				
	RAP implementation	Kaliwa Dam and spillway area, reservoir area	A year after relocation and compensation	MMT	Part of RAP monitoring cost