NAM NGIEP 1
POWER COMPANY

Nam Ngiep 1 Hydropower Project

Environmental Management Monthly Monitoring Report

February 2019

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BBREVIATIONS / ACRONYMS

AIP	Annual Implementation Plan
ADB	Asian Development Bank
BBS	Biodiversity Baseline Survey
BAC	Biodiversity Advisory Committee
BOF	Biodiversity Offset Framework
BOMC	Biodiversity Offset Management Committee
BOMP	Biodiversity Offset Management Plan
CA	Concession Agreement between the NNP1PC and GOL,
CAP	Corrective Action Plan
COD	Commercial Operation Date
CVC	Conventional Vibrated Concrete
CWC	Civil Works Contract
CTA	Common Terms Agreement
DEB	Department of Energy Business, MEM
DEPP	Department of Energy Policy and Planning, MEM
DEQP	Department of Environment and Quality Promotion, MONRE
DESIA	Department of Environmental and Social Impact Assessment, MONRE
DFRM	Department of Forest Resources Management, MONRE
DLA	Department of Land Administration, MONRE
DSRP	Dam Safety Review Panel
EC	Electrolytic Conductivity
ECOCD	EGAT Construction Obligation Commencement Date
EDL	Electricite du Laos
EDL PPA	Power Purchase Agreement between NNP1PC and EDL
EGAT	Electricity Generating Authority of Thailand
EGATi	EGAT International Company Limited
EIA	Environmental Impact Assessment
EMMR	Environmental Management and Monitoring Reports
EMO	Environmental Management Office of ESD within NNP1PC
EMU	Environmental Monitoring Unit
EMWC	Electrical-Mechanical Works Contract
EPF	Environmental Protection Fund
ERIC	Environmental Research Institute Chulalongkhorn University

ERM	Environmental Resource Management
ESD	Environmental and Social Division of NNP1PC
ESMMP	Environmental and Social Monitoring and Management Plan
FY	Fiscal Year
GOL	Government of Lao PDR
GIS	Geographic Information Systems
HH	Household
HMWC	Hydraulic Metal Works Contract
HR	Human Resources
IEE	Initial Environmental Examination
IMA	Independent Monitoring Agency
INRMP	Integrated Natural Resources Management Plan
ISP	Intergraded Spatial Planning
km	kilometre
kV	kilo-Volt
LEPTS	Lao Electric Power Technical Standard
LHSE	Lao Holding State Enterprise
LTA	Lender's Technical Advisor
M	million
m	metre
MAF	Ministry of Agriculture and Forestry
MEM	Ministry of Energy and Mines, Lao PDR
MOF	Ministry of Finance, Lao PDR
MOM	Minutes of Meeting
MONRE	Ministry of Natural Resource and Environment, Lao PDR
MOU	Memorandum of Understanding
NBCA	National Biodiversity Conservation Area
NCI	Non-Compliance Issue
NCR	Non-Compliance Report
NN2	Nam Ngum 2 Power Company Limited
NNP1PC	Nam Ngiep 1 Power Company Limited
NPF	National Protection Forest
NTFP	Non-Timber Forest Products
NT2	Nam Theun 2 Hydropower Project
OC	Obayashi Corporation
ONC	Observation of Non-Compliance
PAFO	Provincial Department of Agriculture and Forestry

PAP	Project Affected People
PD	Property Damage
PONRE	Provincial Department of Natural Resource and Environment, MONRE
PvPA	Provincial Protection Area
RCC	Roller Compacted Concrete
SIR	Site Inspection Report
SLBMP	Salvage Logging Biomass Management Plan
SOP	Standard Operating Procedure
SMO	Social Management Office of ESD within NNP1PC
SS-ESMMP	Site Specific Environmental and Social Monitoring and Management Plan
TD	Technical Division of NNP1PC
TOR	Terms of Reference
TSS	Total Suspended Solids
UAE	United Analysis and Engineering Consultant Company Ltd.
UXO	Unexploded Ordinance
WMF	Watershed Management Fund
WMP	Watershed Management Plan
WRPC	Watershed and Reservoir Protection Committee
WRPO	Watershed and Reservoir Protection Office
WWTS	Waste Water Treatment System

EXECUTIVE SUMMARY

In February 2019, the Environmental Management Office (EMO) of Nam Ngiep 1 Power Company (NNP1PC) received one Site Decommissioning and Rehabilitation Plan and two documents carried over from January 2019 for review and approval.

The monthly site inspection by the Environmental Management Unit (EMU) of Bolikhamxay Province was rescheduled to March 2019. The Quarterly site visit by the EMU of Xaysomboun Province is planned in March 2019.

The effluent monitoring results for the remaining camps in February 2019 indicate that the measurements of BOD_5, COD, faecal coliform and total coliform comply with the relevant Effluent Standard for a few camps whereas the results of a few parameters for Owner's Site Office and Village, Song Da5 Camp No.1, HM Main Camp and IHI Main Camp did not comply with the Standards. Full compliance with the Standard was recorded for V&K Camp and IHI Field Shop 276 Camp.

In February 2019, the dissolved oxygen (DO) concentrations at the surface of the Main Reservoir at R2 (upstream of the main dam some 35 km) were below the Standard of 6 mg/L on 12 and 19 February 2019. The DO levels at the surface of the Main Reservoir (R1, R3, R4 and R5) were between 6.15 mg/L – 8.35 mg/L, Re-regulation Reservoir (R6 and R7) were generally between 6.65 mg/L – 9.52 mg/L, and the DO at Nam Ngiep downstream the re-regulation dam (NNG05) has remained above 7 mg/L.

A total of 100.8 m^3 of solid waste was disposed of at the NNP1 Project landfill, an increase of 8.1 m^3 compared to January 2019. During February 2019, EMO conducted three waste spot checks at the NNP1 Project landfill, construction sites and the camps. A total of 108.5 kg of recyclable waste was sold to Khounmixay Processing Factory by the Contractors. A total of 103 m^3 of solid waste from Phouhomxay, Thahuea and Hat Gniun villages was disposed of at the Houay Soup Landfill.

NNP1PC continued with further improvement of the Lao version of the Nam Ngiep 1 Watershed Management Plan in-house. NNP1PC also discussed with the Department of Forestry (DoF), Ministry Agriculture Forestry (MAF) on a final consultation workshop at the central level and noted that the Vice Minister of MAF will be available to chair the workshop on 13 March 2019.

NNP1PC continued to work with Xaysomboun and Bolikhamxay Provincial WRPOs to finalize the draft Annual Implementation Plan (AIP) 2019. The internal discussion between NNP1PC and WRPOs is scheduled to be held during 6-8 March 2019 and the final draft will be presented during the final consultation workshop on 13 March 2019.

Xaysomboun Provincial WRPO submitted the improved Watershed Management Regulation to Xaysomboun Provincial Assembly for further review and certification on 05 February 2019. The Regulation will be further submitted for Provincial Governor's review and signature after obtaining a clearance from Xaysomboun Provincial Assembly.

ADB provided further comments on the improved Biodiversity Offset Management Plan (BOMP) in the first week of February 2019. NNP1PC together with its Biodiversity Consultant continued improving the plan addressing comments from ADB, IAP and BAC, in particular with respect to developing the intervention logic comprising conservation objectives, threat reduction objectives expected results and management activities in a log frame layout. The improved Plan is expected to be resubmitted to ADB, IAP and BAC in the beginning of March 2019.

The Bolikhamxay Provincial BOMU together with NNP1 EMO have started the preparation of the AIP2019 (for biodiversity management in the Nam Chouan-Nam Xang Offset Site) and the intial draft was ready at the end of February 2019 for further review by NNP1PC. Based on recommendations from IAP and ADB, and as further emphasized by the Head of Bolikhamxay PAFO in January 2019, the aim is to have the AIP2019 approved and ready for implementation by 31 March 2019 when the pre-BOMP2B funding is over to avoid any gaps in implementation.

The fish catch monitoring for January 2019 in Nam Ngiep watershed was dominated by two species groups and three species which are classified as Least Concern (LC) according to the IUCN Red List of Threatened Species.

The recorded catch of Threatened and Near Threatened species (IUCN Red List classification) in January 2019 included three species that is classified as Vulnerable (VU) species and four Near Threatened (NT) species.

1. INTRODUCTION

The Nam Ngiep originates in the mountains of Xieng Khouang Province, flowing through Khoun District into Thathom District of Xaysomboun Province, through Hom District and into Bolikhan District of Bolikhamxay Province. The Nam Ngiep meets the Mekong River just upstream from Pakxan in Bolikhamxay Province (Fig. 1-1).

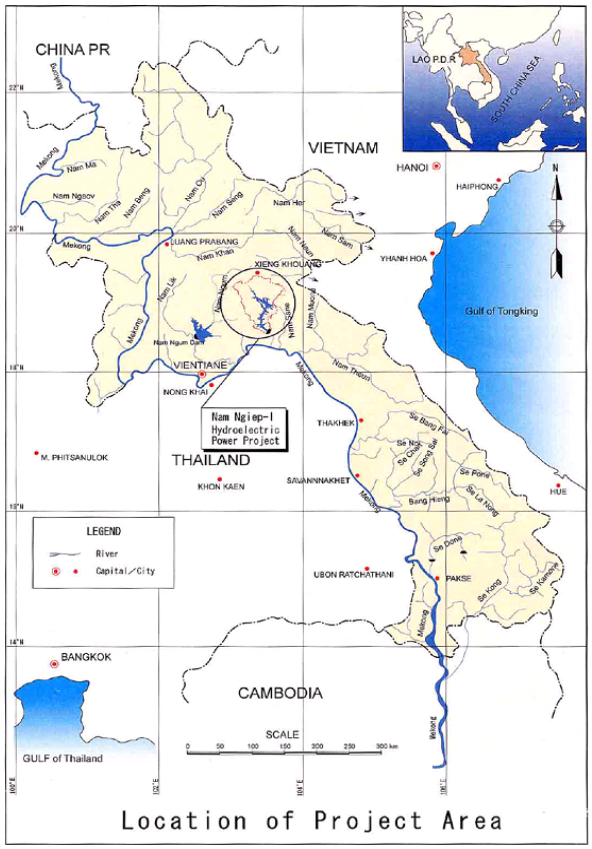


Figure 1-1: Location Map

The project will consist of two dams. The main dam which is located 9.0 km upstream of Hat Gnuin Village in Bolikhan District, will create a 70-km-long, narrow reservoir that extends up the Ngiep Valley as far as Thathom District. At almost 150 m high, the main dam will be the second largest in Lao PDR. The Power Station at this dam will generate up to 272 MW of electricity for export to Thailand. With a combined capacity of 290 MW, Nam Ngiep 1 will generate around 1,620 GWh of electricity annually. Two transmission lines will be required to transport the electricity generated by the project. From the main power station, a 230-kV line will run for 125 km to the Nabong outside Vientiane Capital. A 115-kV transmission line will be constructed by EDL from the Re-regulation Power Station to Pakxan substation over a distance of 40 km.

This Environmental Monthly Monitoring Report (EMMR) provides a summary of environmental monitoring activities and mitigation actions in January 2017. The EMMR was prepared by the Project's Environmental Management Office (EMO). It has been internally reviewed and cleared by EMO senior technical staff and management prior to submitting the report to the Government of Lao PDR (GoL) related agencies.

The EMMR and other related reports including related construction Site Specific Environmental and Social Monitoring and Management Plans (SS-ESMMPs) are publicly disclosed on the Project website in line with the ADB and GoL Public Disclosure Policies. Hard copies of the final reports will also be available upon requests at the Project's main office in Vientiane Capital and field office in Pakxan, Bolikhamxay Province.

2. WORK PROGRESS OF PRINCIPAL CONTRACTORS

Construction works for the Project are being carried out through four separate main construction contracts under the supervision of the Technical Division of NNP1PC. The four contracts are the Civil Works, the Electrical and Mechanical Works, the Hydraulic Metal or Hydro-Mechanical Works and the 230 kV Transmission Line Works.

Figure 4-2 shows the overall progress of the Project in terms of value of work done and paid. It is shown that all works are substantially complete except for the Hydro-Mechanical Works.

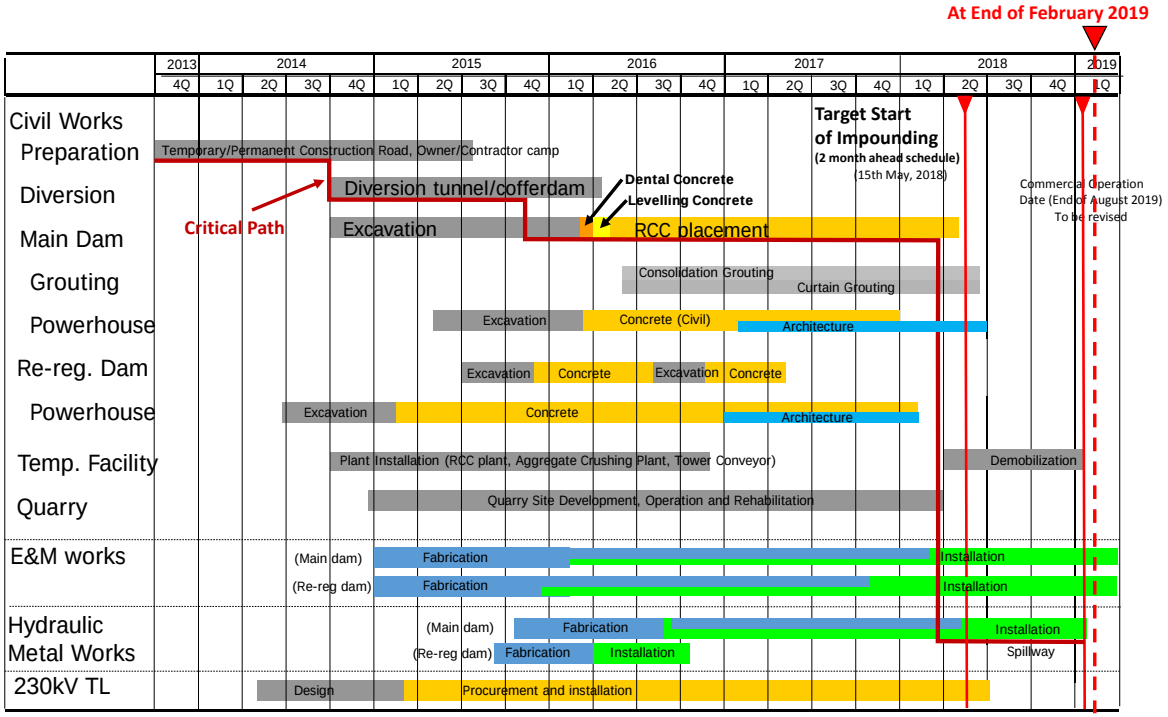
In fact the works of this Contractor are complete but not yet paid under contract payment terms. Both Civil and Transmission Works are complete except for minor outstanding work and defects with the Civil Contractor carrying out almost 20 per cent more value of work in the original contract period. The Electrical and Mechanical Works Contractor is shown almost 100 per cent complete but additional work has been necessary to disassemble and reassemble the units due to the main powerhouse inclination problem. Actual overall cumulative work progress by value of work carried out and paid for until the end of February 2019 was 99.7 %[1] (compared to planned progress of 99.6 %), based on achieved Interim Milestone Payments for all Contracts excluding the value of Advance Payments, varied works and other adjustments allowed under each Contract. In terms of the value of actual work done the percentage is understated since work completed, but not paid, is not included.

The overall construction schedule and progress curve (by achieved Milestone Payments) are shown in ***Figure 2-1***.

[1] The progress to-date is calculated as (Cumulative Amount of Achieved Interim Milestone Payments) / (Total Agreed Original Price of Construction Contracts) and expressed as a percentage. These totals exclude varied works and other adjustments allowed under each Contract.

[2]The progress to-date is calculated as (Cumulative Value Achieved for Completed Work by Variation Order or Other Adjustment) / (Total Budget Contingency Amount)

Figure 2-1: Overall Construction Schedule



2.1 Civil Work

The Civil Works Contract was executed between Obayashi Corporation and the Nam Ngiep 1 Power Company on 30 September 2013 and the Notice to Proceed was issued on 03 October 2014. Excavation works of the main dam, the diversion tunnel and the re-regulation dam were commenced in October 2014 and completed in February 2016, following which the concreting works were commenced.

The cumulative actual work progress of the Civil Works until the end of February 2019 was 100 % (compared to planned progress of 100 %) calculated in the same manner as described above for the value of achieved Interim Milestone Payments excluding advance payment.

2.1.1 Main dam and power house

After starting the main dam excavation works in October 2014 on the left bank, the works were about one month advanced when diversion of the Nam Ngiep River was achieved at the end of October 2015. However, excavated volumes were 20% greater than expected and part of this additional work is necessary to construct a 'shear key' structure due to the weak layers of rock encountered in the dam foundation. Following the efforts on Site, the additional excavation work was completed at the end of February 2016.

2.1.2 Re-regulation dam and powerhouse

The re-regulation powerhouse excavation and cofferdam works for the first river diversion were commenced in early October 2014. The excavation works for the powerhouse on the left bank were fully completed down to El. 146.7 m at the end of February 2015.

Structural concrete works were commenced in March 2015, in coordination with installation of the grounding system. The progress of structural concrete works is shown in ***Figure 2-2*** below:

Figure 2-2: Completed Re-regulation Dam and Powerhouse at the End of June 2018

2.1.3 Temporary work facility

2.1.3.1 DIVERSION TUNNEL INLET AND OUTLET

The diversion tunnel, excavated over 600 m in length and 10 m in diameter, was commenced in October 2014 by drill and blast techniques and completed in late September 2015. The river diversion took place on 31 October 2015 after completion of inlet and outlet structures together with construction of earth-fill cofferdams upstream and downstream.

The second diversion to divert the river from the diversion tunnel through the bottom outlet or conduit in the dam was implemented on 13 January 2018. Dewatering of the diversion tunnel and construction of the concrete plug was commenced during January 2018. Concrete works and the valve installation for discharge was completed before the start of main dam impounding. On 22 May 2018, the valve discharge commenced by using 3 valves with around 5 m^3/s discharge in total. Construction of concrete plug including valve was completed on 27 January 2019.

2.1.3.2 SECONDARY UPSTREAM COFFERDAM

The concrete placement works in both conventional and roller compacted concrete (CVC and RCC respectively) for the secondary upstream cofferdam were started in November 2015 and completed ahead of construction schedule in the middle of February 2016. The grout curtain works were completed on 02 April 2016.

2.1.3.3 PLANT YARDS

These comprise the Aggregate Crushing Plant, the CVC Batching Plant and the RCC Batching Plant.

Foundation work and installation of equipment were completed at all the plant yards and the belt conveyor system from the RCC plant to the main dam was completed in early April

2016. Decommissioning and rehabilitation is underway on both plants and almost completed for the Aggregate Crushing Plant.

2.1.3.4 QUARRY

After removal of overburden the excavation of raw materials for aggregate crushing were started in July 2015. The nature and type of the rock being exploited is acceptable though unsuitable soil layers are removed to spoil disposal areas, and good quarry management continues.

2.1.3.5 DISPOSAL AREAS

The disposal area on the right bank has been available for operation since January 2015, as was the adjacent waste disposal area. The Disposal Area No.9 along Road P1 near the entrance of Road T5 started operation in April 2015. Unsuitable material from the quarry continues to be hauled to Disposal Area No.6 and Disposal Area No.9 is being developed the Electrical and Mechanical Works Contractor as stated above.

2.2 Electrical and Mechanical Works

The EMW Contract was executed between Hitachi-Mitsubishi Hydro Corporation and NNP1PC on 13 June 2014 and the NTP was issued in 03 October 2014. The cumulative work progress of the Electrical and Mechanical Works by value at the end of January 2019 was 98.8 % (compared to planned progress of 100.0 %).

Figure 4.2-1: Disassembly of lower guide bearing for Unit 1

Figure 4.2-2: Disassembly of turbine guide bearing for Unit 1

Figure 4.2-3: Reassembly of loose flange for Unit 1

Figure 4.2-4: Reassembly of upper guide bearing for Unit 2

Figure 4.2-5: Assembly of 3 pieces of keys for stator frame for Unit 2

Figure 4.2-6: Reassembly of turbine guide bearing for Unit 2

Figure 4.2-7: Reassembly of piping inside turbine pit for Unit 2

Figure 4.2-8: Reassembly of loose flange for Unit 1

Figure 4.2-9: Installation of power cable for AVR and Excitation system for Unit 2

Figure 4.2-10: Inspection for Dam Control Centre

Figure 4.2-11: Manual start initial spinning test, vibration test and bearing run test of generator unit

Figure 4.2-12: Generator of voltage and frequency adjustable range measurement

Figure 4.2-13: Phase rotation test and voltage waveform measurement

Figure 4.2-14: Unit start/stop automatic sequence control test

Figure 4.2-15: Synchronization test for generator unit with EDL transmission system

Figure 4.2-16: 115 kV transmission line protection system test and test of CT, PT circuit for protective device

Figure 4.2-17: Active power load rejection test of 25 %, 50 %, 75 % and 100 % load

Figure 4.2-18: Meter reading between EDL and NNP1 of data logging

Figure 4.2-19: Output/guide vane stroke relationship test and water flow measurement

Figure 4.2-20: Minimum loads continuous stability test

2.3 Hydro-Mechanical Works

The HMW Contract was executed between IHI Infrastructure Systems (IIS) and NNP1PC on 18 April 2014 and the NTP was issued to the Contractor on 03 October 2014. The actual cumulative work progress of the Hydro-Mechanical Works until the end of February 2019 was 99 % (compared to planned progress of 99 %). The main activities carried out during this month are described below:

Table 2-1 : Progress of Spillway Gate Erection at the Main Dam at the End of February 2019.

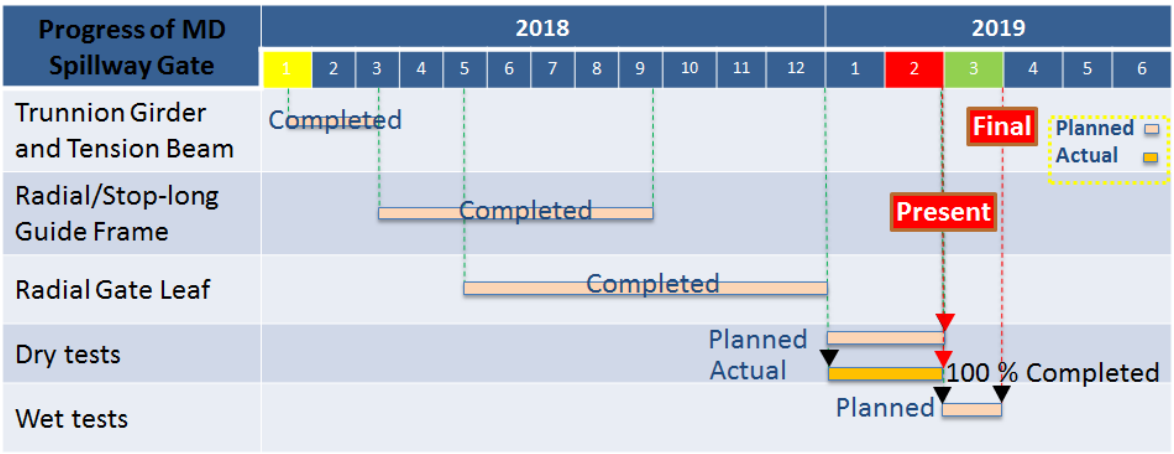


Figure 2-3: Progress of Spillway Gate Erection at the Main Dam in February 2019

Figure 2-4: Functional test (Dry test) of the gate leaf for the spillway gate No.2 at the Main Dam in February 2019.

Figure 2-5 : Spillway Gate in Operation from the Spillway Gate No. 4 at the Main Dam in February 2019.

2.4 230kV Transmission Line Works

The TLW Contract was executed between Loxley-Sri Consortium and NNP1PC on 11 July 2014 and the NTP was issued to the 230 kV TL Contractor on 03 October 2014. The cumulative work progress of the Transmission Line Works until the end of June 2018 was 100 % (compared to planned progress of 100 %).

Figure 2-6: Tower No. 3

Figure 2-7: Preparation for Megger Test Section PWH-T3 & Visual Check along the Line Route before the Energization Test

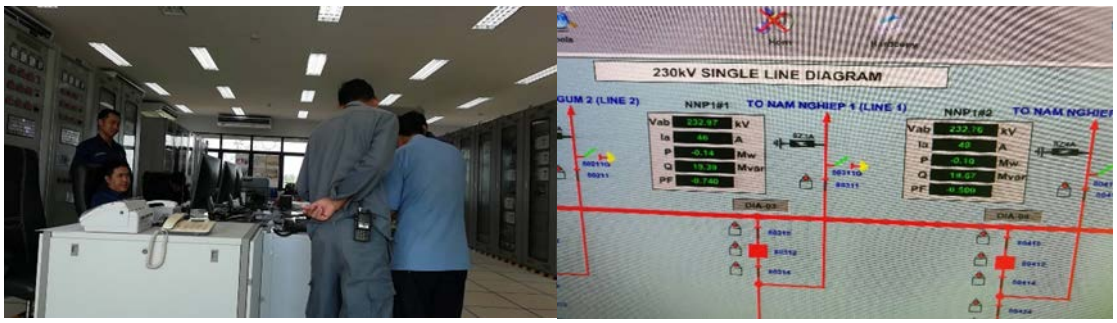


Figure 2-8: The energization work for the 230 kV Transmission Line from Nabong Substation to Main Power House NNP1

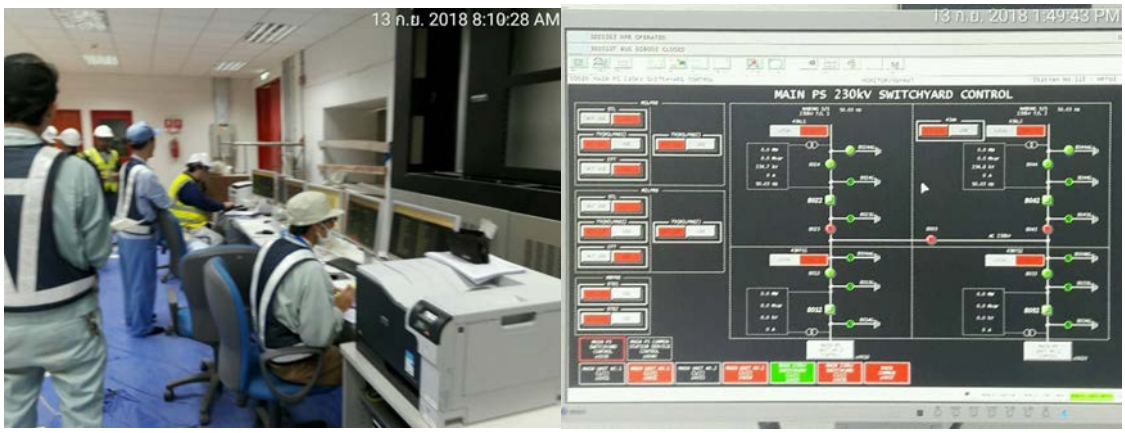


Figure 2-9: The Energization Work for the 230 kV Transmission Line from Nabong Substation to Main Power House NNP1.

3. ENVIRONMENTAL MANAGEMENT MONITORING

3.1 Compliance Management

In February 2019, the Environmental Management Office (EMO) of Nam Ngiep 1 Power Company (NNP1PC) received one Site Decommissioning and Rehabilitation Plan and two documents carried over from January 2019 for review and approval.

Table 3-1*: Summary of ONC and NCR*

Items	ONC	NCR-1	NCR-2	NCR-3
Carried over from January 2019	5	1	1	0
Newly Opened in February 2019	6	0	0	0
Total in February 2019	**11**	**1**	**1**	**0**
Resolved in February 2019	8	1	0	0
Carried over to March 2019	3	0	1	0
Unsolved Exceeding Deadlines	**2**	**0**	**1**	**0**

3.1.1 Inspection by Environment Monitoring Unit

The monthly site inspection by the Environmental Management Unit (EMU) of Bolikhamxay Province was rescheduled to March 2019. The Quarterly site visit by the EMU Xaysomboun Province is planned for March 2019.

3.2 Environmental Quality Monitoring

The analyses of Total Suspended Solids (TSS), Biochemical Oxygen Demand (BOD5), faecal coliform, E. Coli bacteria and total coliform have been carried out by NNP1PC Environmental Laboratory since August 2017.

All data are reported to the Ministry of Natural Resources and Environment (MONRE) and the Project Lenders on a monthly and quarterly basis and published on the Company website https://namngiep1.com/resources/monitoring-reports/.

3.2.1 Effluent Discharge from Camps and Construction Sites

Detailed monitoring results are provided in ***Annex B*** of this Report. The effluent monitoring results for the camps in February 2019 indicate that the measurements of BOD_5, COD, faecal coliform and total coliform comply with the relevant effluent standards for a few camps whereas the results of a few parameters for Owner's Site Office and Village, Song Da5 Camp No.1, HM Main Camp and IHI Main Camp did not comply with the Standards. V&K Camp and IHI Field Shop 276 Camp were fully compliant with the Standard.

Following the completion of the RCC placement work at the Main Dam by the end of April 2018, the production at the aggregate crushing plant and the RCC plant has stopped and the associated sediment retention ponds are therefore no longer in operation.

EMO discontinued the water sampling at the RCC Plant, Aggregate Crushing Plant, Sino Hydro Camp and Kenber Camp because these sites were decommissioned in November 2018.

The status of implementation of the corrective actions addressing non-compliances at the camps and key construction sites that continue to have non-compliances is summarized in ***Table 3-2***.

Table 3-2: Status of Corrective Actions at Camps and Construction Sites

Site	Sampling ID	Status	Corrective Actions
Owner's Site Office and Village (OSOV)	EF01	Non-compliance for total coliform, total nitrogen, ammonia-nitrogen and BOD_5. However, total coliform was back to compliant with the standard in the second fortnight sampling.	The improvement of the wetland ponds was completed in January 2019. The February monitoring results show that total coliform is back in compliance with the standard
Obayashi Corporation Camp	EF02	Non-compliance for total nitrogen and ammonia-nitrogen.	The Contractor has been advised to improve the operation of the waste water treatment system. The results will be monitored and reported in March 2019 Report.
Song Da5 Camp No. 1	EF07	Non-compliance for ammonia nitrogen, total nitrogen, BOD_5, faecal coliform and total coliform.	The Contractor has been advised to improve chlorine dosing and system maintenance. Results will be reported in the next MPR.
Song Da5 Camp No. 2	EF08	No sampling due to the last pond of this camp's wetland system was dried-up and the camp is being decommissioned.	
Zhefu Camp (Subcontractor of Hitachi-Mitsubishi Hydro)	EF09	Non-compliance for ammonia nitrogen and total nitrogen.	The Contractor has been advised to improve system maintenance.
V&K Camp	EF10	Full compliance.	No action is required.

Site	Sampling ID	Status	Corrective Actions
HMH Main Camp (WWTS)	EF13	Non-compliance for BOD_5, COD, ammonia nitrogen, total nitrogen and oil & grease.	The Contractor was suggested to readjust the auto pump and change chlorination method from a batch treatment to an automatic chlorine dripping method.
IHI Main Camp	EF14	Non-compliance for COD, ammonia-nitrogen and total nitrogen. However, COD was back in compliance with the standard in the second fortnight mission.	EMO will follow up on this issue and report in the next monitoring period.
IHI Field Shop 276 Camp	EF18	Full compliance.	No action is required.

3.2.2 Ambient Surface Water Quality Monitoring

The ambient surface water quality monitoring programme comprises 5 monitoring stations in the main reservoir (R1-R5), 2 stations in the re-regulation reservoir (R6 and R7), 5 stations in the mainstream Nam Ngiep (NNG01 and NNG05 to NNG08) and 4 stations in the main tributaries to Nam Ngiep (Nam Chiane [NCH01], Nam Phouan [NPH01], Nam Xao [NXA01] and Nam Houay Soup [NHS01]).
In addition, weekly depth profile monitoring (pH, DO, Conductivity, TDS and Temperature) was started on 18 September 2018 for stations located in the re-regulation and main reservoirs.

Table 3-3: Monitoring Frequency for Surface Water Quality Parameters

Frequency of Monitoring	Parameters (Unit)	Monitoring Sites
Saturday	pH, DO (%), DO (mg/l), Conductivity (µs/cm), TDS (mg/l), Temperature (°C) and Turbidity (NTU)	- R5, main reservoir immediately upstream the main dam; - NNG05, Nam Ngiep downstream the re-regulation dam at Hat Gniun Village

Frequency of Monitoring	Parameters (Unit)	Monitoring Sites
Weekly	pH, DO (%), DO (mg/l), Conductivity (µs/cm), TDS (mg/l), Temperature (°C), Turbidity (NTU), TSS (mg/l), BOD_5 (mg/l), Faecal coliform (MPN/100 ml), Total coliform (MPN/100 ml)	- Main Reservoir: R1, R2, R3, R4, R5 - Re-regulation Reservoir: R6, R7 - Nam Ngiep downstream: NNG05 - Tributaries: NPH01, Nam Phouan
Fortnightly	pH, DO (%), DO (mg/l), Conductivity (µs/cm), TDS (mg/l), Temperature (°C), Turbidity (NTU)	All stations
Monthly	TSS (mg/l), BOD_5 (mg/l), COD (mg/l), NH_3-N (mg/l), NO_3-N (mg/l), total coliform (MPN/100 ml), faecal coliform (MPN/100 ml) and Hydrogen sulphide (mg/l)	All stations

The monitoring results for key parameters (DO, TSS and BOD_5) during February 2019 are presented in ***Table 3-4, Table 3-5, and Table 3-6.*** The full set of data for February 2019 is attached in ***Annex A***. In addition, the results for DO are presented as line graphs in ***Figure 3-1.***

Re-regulation Reservoir

The level of DO in both R6 and R7 has remained well above 6.84 mg/L in the whole water column and with water temperatures unchanged from the surface to the bottom of the reservoir. There are no indications of a thermocline.

Main Reservoir

At R5, the DO level in the upper 4.0 m fluctuated from about 6.06 mg/L to 7.5 mg/L, and the entire water column below 15.0 m had DO levels less than 2.13 mg/L.

At R4, the DO level in the upper 6.5 m fluctuated from about 5.23 mg/L to 8.04 mg/L and the entire water column below 10.0 m had DO levels below 0.97 mg/L.

The DO concentrations at R3 were recorded between 5.5 mg/L to 8.25 mg/L in the upper 4.0 m, and the concentration of DO in the entire water column below 5.5 m was less than 1.77 mg/L.

The DO concentrations at R2 were between 1.51 mg/L to 3.14 mg/L in the upper 2.5 m on 12 February 2019 and DO level was between 5.34 mg/L – 7.37 mg/L in upper 2.0 m on 05, 19 and 26 February 2018. The DO concentration at R2 in entire water column between 5.0 – 18.0 m were 0.04 mg/L to 1.87 mg/L and DO level increased from 0.05 mg/L to 4.28 mg/L at 19.0 m until the bottom during February 2019.

The DO concentrations in the entire water column at R1 were from 5.87 mg/L to 9.11 mg/L.

The measurements indicate the formation of an oxycline in R2-R5.

As expected, the TSS concentrations in the main reservoir have been consistently low since the start of impounding with a mean in R4 and R5 of 5 mg/L compared to high flow season means of about 100 mg/L – 250 mg/L and low flow season means of 20 mg/L - 50 mg/L.

The BOD_5 measurements show – as expected – increasing levels in R1 and R5 in the main reservoir since about one month into impounding.

Figure 3-1: Surface Water and Re-Regulation Reservoir Water Quality Monitoring Stations

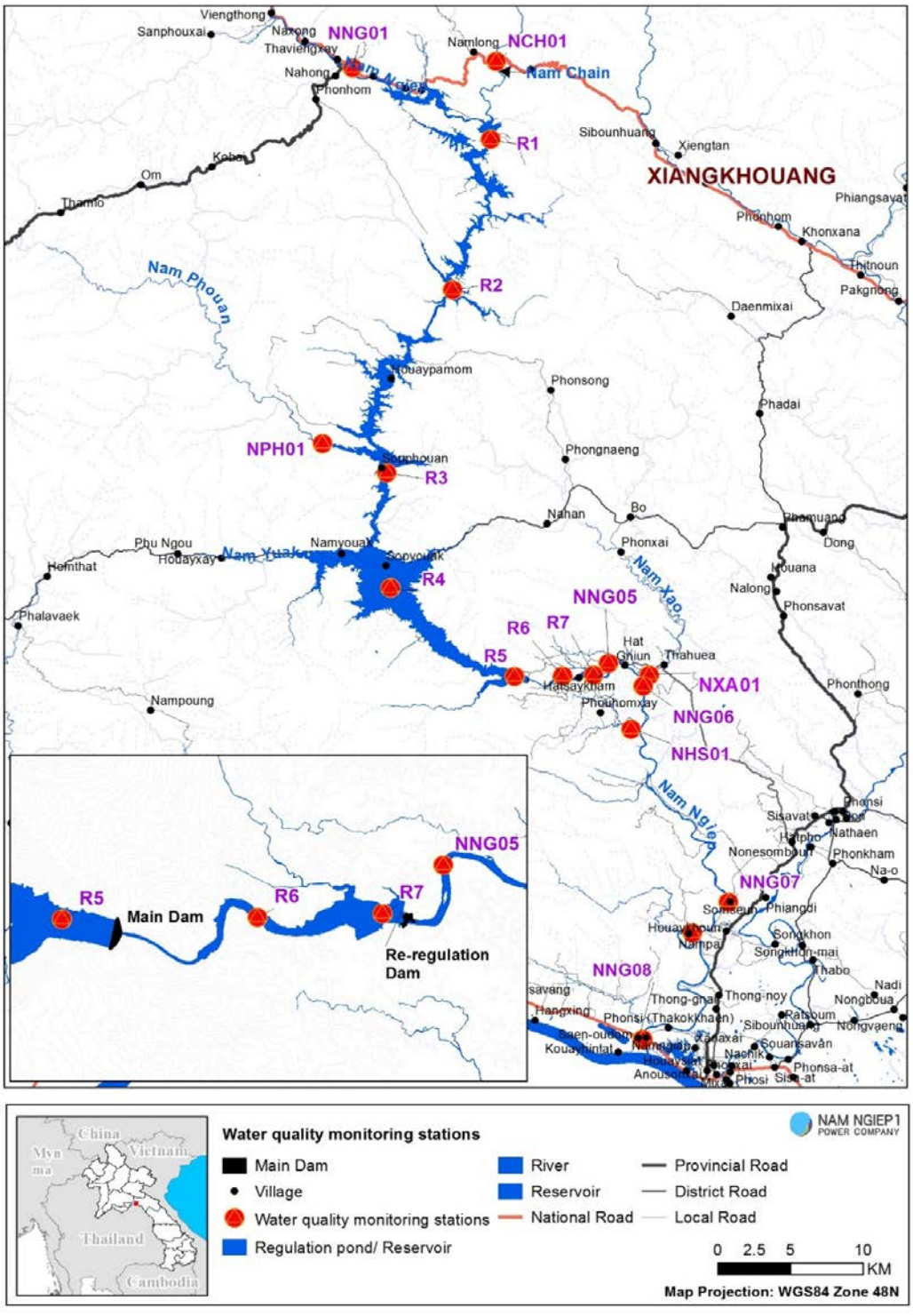


***Figure 3-2**: Concentration of Dissolved Oxygen in the upper 0.5 m since the Start of Impounding*

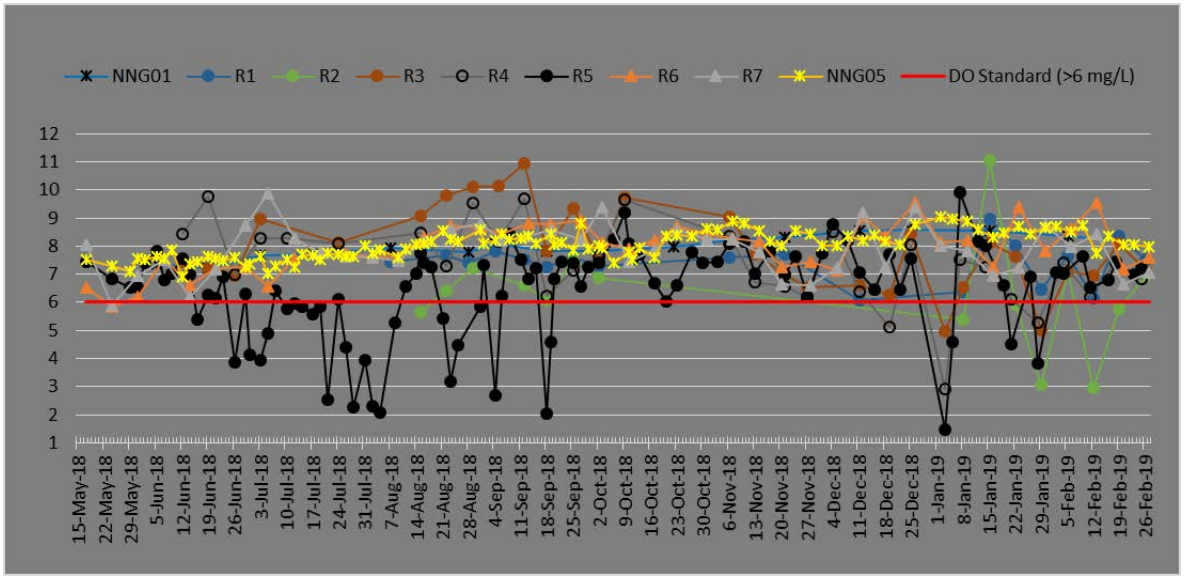


***Table 3-4:** Results of Surface Water Quality Monitoring for Dissolved Oxygen (mg/L) in the upper 0.5 m - Water Quality Standard: > 6.0 mg/L*

Dissolved Oxygen (mg/L)	NNG01	R1	R2	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
2-Feb-19						7.06			8.69							
4-Feb-19					7.42	7.04										
5-Feb-19	8.37	7.66	7.09	7.11									8.81	9.06		
6-Feb-19							8.63	7.98	8.49	7.75	7.97	7.99			7.2	7.82
9-Feb-19						7.65			8.72							
11-Feb-19					6.17	6.51										
12-Feb-19		6.16	2.94	6.94										8.9		
13-Feb-19							9.52	8.44	7.75	7.33	7.63	7.82			6.72	7.06
16-Feb-19						6.78			8.36							
18-Feb-19					7.43	7.42										
19-Feb-19	8.22	8.35	5.78	8.09									8.29	10.12		
20-Feb-19							7.19	6.65	8.06	8.14	7.79	7.32			6.71	6.09
23-Feb-19						6.99			8.04							
25-Feb-19					6.83	7.23										
26-Feb-19		7.5	6.93	7.15										8.21		
27-Feb-19							7.6	7.07	7.97	7.89	7.61	7.4			6.36	7.72

Table 3-5: Results of Surface Water Quality Monitoring for Total Suspended Solids (mg/L) - Water Quality Standard: No Standard

Total Suspended Solids (mg/L)	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
4-Feb-19					<5	<5										
5-Feb-19	22.5	<5	<5	<5									8.44	<5		
6-Feb-19							19.34	6.11	9.39	6.56	<5	8.77			<5	<5
11-Feb-19						<5										
13-Feb-19							6.98	<5	<5							
18-Feb-19						<5										
20-Feb-19							16.41	20	29.58							
4-Feb-19					<5	<5										
5-Feb-19	22.5	<5	<5	<5									8.44	<5		
6-Feb-19							19.34	6.11	9.39	6.56	<5	8.77			<5	<5
11-Feb-19						<5										

Table 3-6 *Results of Surface Water Quality Monitoring for BOD5 (mg/L) - Water Quality Standard: < 1.5 mg/L*

BOD5 (mg/L)	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
4-Feb-19					<1	1.54										
5-Feb-19	<1	1.1	<1	<1									<1	<1		
6-Feb-19							1.1	<1	1.08	1.13	1.1	1.12			1.01	1.1
11-Feb-19						<1										
13-Feb-19							<1	<1	<1							
18-Feb-19						<1										
20-Feb-19							<1	<1	<1							

3.2.3 Groundwater Quality Monitoring

During February 2019, community groundwater quality analyses were carried out for four waterwells located in Somseun Village, Nam Pa Village, Thong Noi Village and Pou Village.

All results of community groundwater complied with the groundwater quality standards for water supply purposes.

Table 3-7: Groundwater Quality Monitoring Results, Somsuen, Nam Pa, Thongnoi and Pou Villages

Date	Parameter (Unit)	Site Name	Somseun Village	Nam Pa Village	Thong Noy Village	Pou Village
		Station	GSXN01	GNPA01	GTHN01	GPOU01
		Guideline				
14-Feb-19	pH	6.5 - 9.2	7.7	7.01	6.95	7.76
14-Feb-19	Sat. DO (%)		84.3	83.1	87.1	88
14-Feb-19	DO (mg/l)		6.8	6.55	6.82	6.88
14-Feb-19	Conductivity (µS/cm)		221	336	320	23
14-Feb-19	TDS (mg/l)		110	168	160	11.5
14-Feb-19	Temperature (°C)		24.7	26.6	27	25.2
14-Feb-19	Turbidity (NTU)	<20	1.07	1.45	1.88	1.26
14-Feb-19	Faecal coliform (MPN/100 ml)	0	0	0	0	0
14-Feb-19	E. Coli Bacteria (MPN/100 ml)	0	0	0	0	0

3.2.4 Gravity Fed Water Supply (GFWS) Quality Monitoring

During January 2019, water samples from water taps at Thahuea Village, Hat Gniun Village and Phouhomxay Village were analysed. The WPHX01 represents raw water in the head tank before filtration.

The results of the water quality analyses are presented in ***Table 3-8.*** All parameters complied with the National Drinking Water Standards except for faecal coliforms and E.Coli at WTHH02, WHGN02, WPHX01, WPHX02 (tap water at the primary school in Phouhomxay Village) and WPHX03 (tap water at a house in Phouhomxay Village). The villagers were informed about the results and encouraged to boil the water before drinking.

Table 3-8: Result Gravity Fed Water Supply (GFWS) Quality Monitoring

Date	Parameter (Unit)	Site Name	Thaheau Village	Hat Gnuin Village	Phouhomsay Village		
		Station	WTHH02	WHGN02	WPHX01	WPHX02	WPHX03
		Guideline					
22-Feb-19	pH	6.5 - 8.6	8.31	8.44	8.69	8.6	8.25
22-Feb-19	Sat. DO (%)		96.6	105.9	95.6	93.6	88.9
22-Feb-19	DO (mg/l)		7.8	8.56	7.97	7.67	7.39
22-Feb-19	Conductivity (µS/cm)	<1,000	48.4	63.2	17.16	17.38	16.41
22-Feb-19	TDS (mg/l)	<600	24.2	31.6	8.58	8.69	8.25
22-Feb-19	Temperature (°C)	<35	25.3	25.1	23.2	24.2	23.4
22-Feb-19	Turbidity (NTU)	<10	1.13	2.58	0.76	0.8	0.69
22-Feb-19	Faecal Coliform (MPN/100 ml)	0	49	22	33	33	49
22-Feb-19	E.coli Bacteria (MPN/100 ml)	0	49	22	17	17	22

3.2.5 Landfill Leachate Monitoring

During February 2019, the landfill leachate monitoring was not conducted at NNP1 Project Landfill and at Houay Soup Solid Waste Landfill because there was no leachate collected in the treatment ponds (all evaporated).

3.2.6 Dust Monitoring

The results indicate that the dust levels at all monitoring stations complied with the National Standard, except at the Main Powerhouse during 25-26 February 2019 which was found to be slightly higher than the Standard at 0.129 mg/m^3. The results were shared internally with other relevant NNP1PC Technical Departments as a reference for follow-up inspection to ensure proper establishment of health and safety procedures.

3.2.7 Noise Monitoring

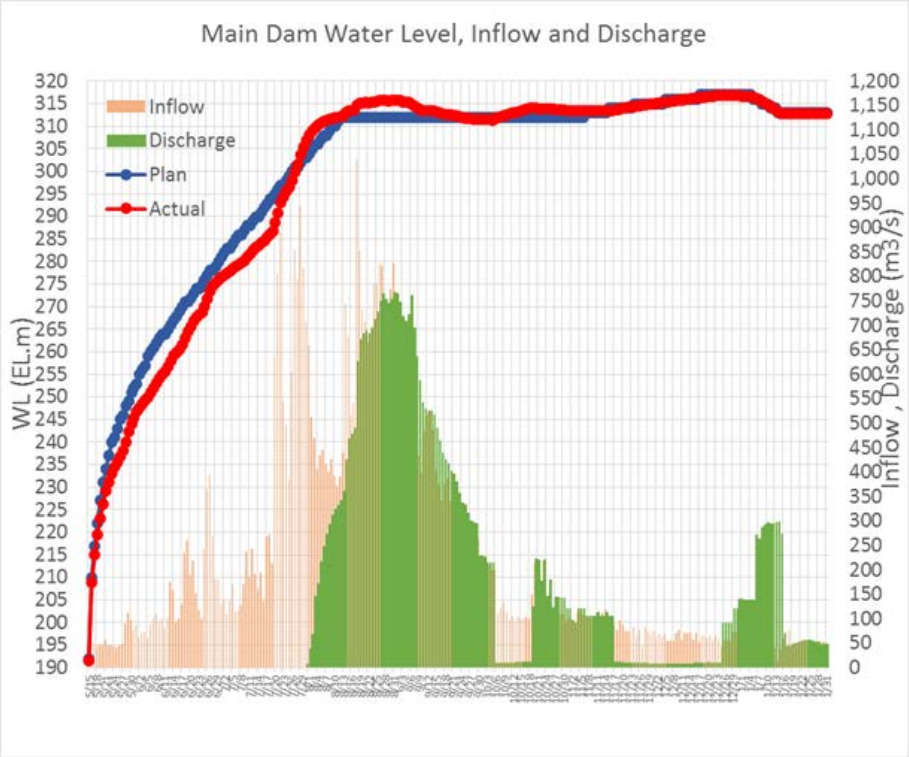
During February 2019, noise monitoring was conducted for 72 consecutive hours at Hat Gniun Village and Phouhomxay Village, and for 24 consecutive hours at the Main Dam, Song Da 5 Camp No.2, Lilama 10 Camp, and the Main Powerhouse.

The results indicate that the recorded maximum noise levels and averaged noise levels complied with the Standard for all stations.

3.2.8 Discharge Monitoring

The progress of impounding from 15 May 2018 to 28 February 2019 is presented on the graph in ***Figure 3-3*** indicating the water level in the main reservoir, the inflow to the main reservoir and the discharge from the main reservoir into the re-regulation reservoir. The inflow data shows the gradual reduction in flows from the end of the wet season into the dry season with inflows from about 100 m^3/s at the beginning of November 2018 to an average of about 50 m^3/s during February 2019.

Figure 3-3: Progress of Impounding the Main Reservoir

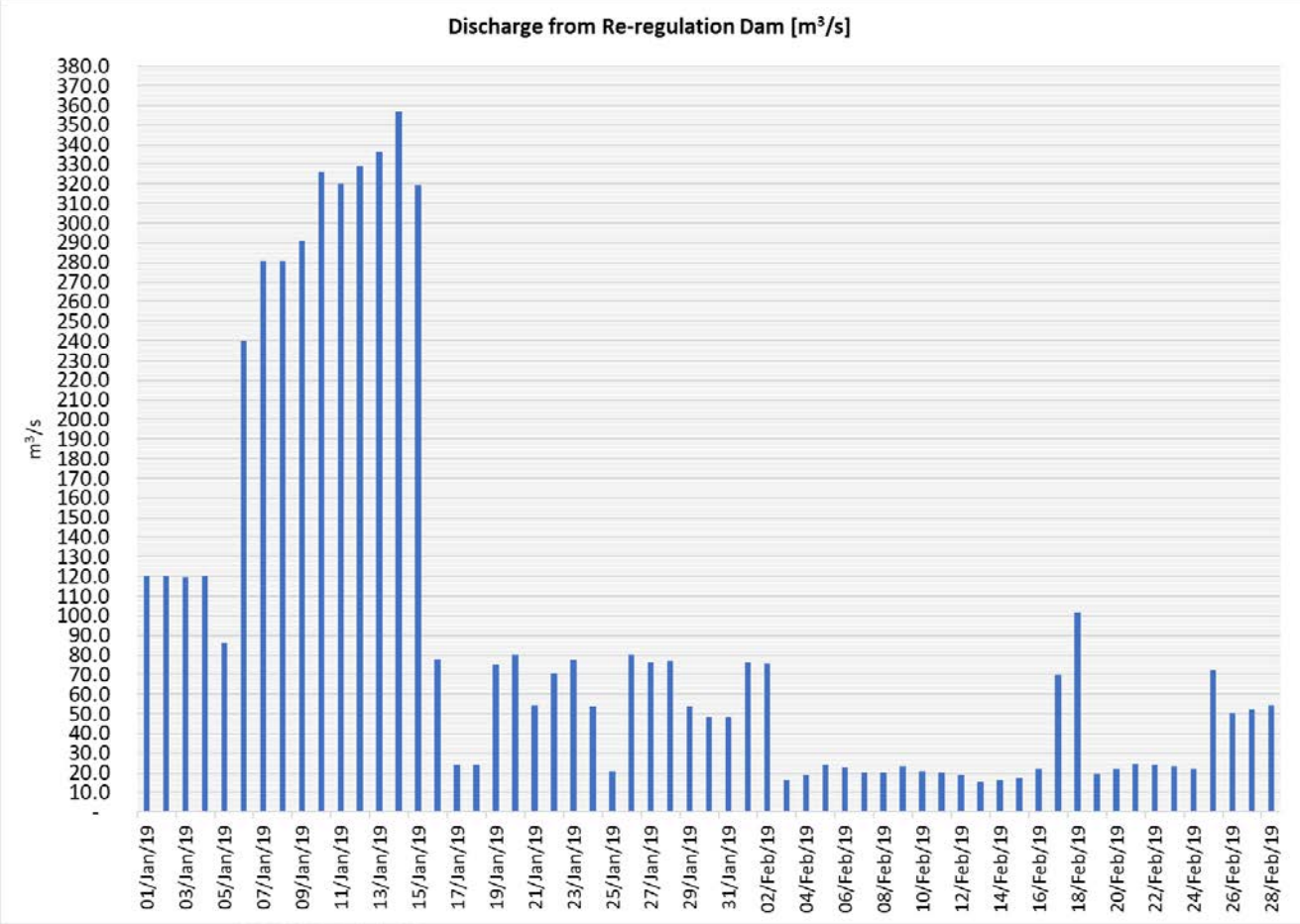


On 17 November 2018 the impounding of the main reservoir was restarted and continued until 25 December 2018. The water level in the reservoir rose with 3.2 m from El. 313.6 masl on 17 November 2018 to El. 316.8 masl on 25 December 2018. In the same period, the discharges from the main dam and the re-regulation dam were reduced (see ***Figure 1-3***) and maintained close to 10 m^3/s, which is well above the minimum flow requirement of 5.5 m^3/s. On 25 December 2018 the discharge from the main dam and the re-regulation dam was increased to equal the inflow to the main reservoir and this was maintained during the remaining part of December 2018. As presented in ***Figure 1-4***, in the first 2 weeks of January 2019, the discharge from the re-regulation dam was increased to about 300 m^3/s or about 250 m^3/s above the inflow to the main reservoir thereby lowering the water level in the main reservoir with about 4 m to El. 312.8 masl. During the remaining part of January 2019, the discharge from the re-regulation dam was generally kept about 10-20 m^3/s above the inflow to the main reservoir.

From 03 February 2019 to 25 February 2019, the mean discharge from the re-regulation dam was kept at about 20 m^3/s (approximately 20 m^3/s lower than the inflow to the main reservoir), however with intermittent higher outflows in connection with testing of the turbine and the power generation in the re-regulation powerhouse.

The changes in the discharge from the re-regulation dam were informed in advance to the RMU and to the heads of the downstream villages, who then announced the changes to the communities over the village speaker systems.

Figure 3-4: **Discharge Monitoring at the Re-regulation Dam.**



3.2.9 Nam Ngiep Downstream Water Depth Monitoring

In February 2019, EMO carried out four boat missions to monitor the water depth in Nam Ngiep downstream of the re-regulation dam. EMO has currently identified 19 sites with potential shallow water depths. The monitoring showed that all these sites had water depths from 0.2 – 1.7 m with some difficulties navigating on 6 February 2019 (4 sites), 13 February 2019 (8 sites), 20 February 2019 (2 sites) along the river due to the decreased discharge from the re-regulation dam as mentioned in Section 1.3 above.

3.3 PROJECT WASTE MANAGEMENT

3.3.1 Solid Waste Management

In February 2019, a total of 100.8 m^3 of solid waste was disposed of at the NNP1 Project landfill, an increase of 8.1 m^3 compared to January 2019. During February 2019, EMO conducted three waste spot checks at the NNP1 Project Landfill, construction sites and the camps. Mixed waste was found to be disposed at waste pit No.2 by OC, ZHEFU, LILAMA 10, 276, Song Da5, V&K and GFE camp. NNP1PC instructed the supervisors of all concerned Contractors and subcontractors to ensure proper waste management practices. The NNP1 Project landfill maintenance work is carried out by Administration Department with EMO support which includes waste cleaning-up, grass cutting and repairing perimeter fences.

A total of 108.5 kg of recyclable waste was sold to Khounmixay Processing Factory by the Contractors. The remaining scrap metal will be sold or transported off site by the Contractor later on.

Table 3-9: Amounts of Recyclable Waste Sold

Source and Type of Recycled Waste		Unit	Sold	Cumulative Total by 28 February 2019
Construction Activity				
1	Scrap metal	kg	0	49,239
Sub-Total 1		**kg**	**0**	**49,239**
Camp Operations				
2	Glass bottles	kg	26	590
3	Plastic bottles	kg	28	243
4	Paper/Cardboard	kg	50	166
5	Aluminium cans	kg	4.5	97
Sub-Total 2		**kg**	**108.5**	**1,096**
Grand Total 1+2		**kg**	**108.5**	**50,335**

The villagers of Phouhomsay Village collected a total of 3,596 kg of food waste from selected camps for animal feed in February 2019, a decrease of 319 kg compared to January 2019 as a result of Kenber Camp decommissioning and a reduction in the number of construction workers at Song Da5 Camps.

Table 3-10 Amounts of Food Waste Collected by Villagers

No.	Site Name	Unit	Total
1	Song Da5 Camp No. 2	kg	81
2	Song Da5 Camp No. 1	kg	602
3	Obayashi Corporation Camp	kg	1,064
4	Owner's Village and Site Office (OSOV)	kg	1,115
5	LILAMA10 Camp	kg	734
Total		**Total**	**kg**

3.3.2 Hazardous Materials and Waste Management

The types and amounts of hazardous waste collected and transported for off-site treatment and final disposal at Khounmixay Processing Factory in February 2019.

Table 3-11: Results of Hazardous Material Inventory

No.	Hazardous Waste Type	Unit	Total in February 2019 (A)	Disposed (B)	Remainder (A - B)
1	Used hydraulic and engine oil	Litre	4,690	1,000	3,690
2	Contaminated soil, sawdust and concrete	bag	515	0	515
3	Used oil filters	Piece	205	0	205
4	Used tyre	Piece	232	0	232
5	Used oil mixed with water	Litre	200	0	200
6	Ink cartridge	unit	134	0	134
7	Halogen/fluorescent bulbs	unit	136	0	136
8	Empty paint and spray cans	can	126	0	126
9	Empty contaminated bitumen drum/container	Drum (200L)	93	0	93
10	Empty used oil drum/container	Drum (20 L)	44	0	44
11	Empty used chemical drum/container	Drum (200L)	34	0	34
12	Contaminated textile and material	kg	27	0	27
13	Lead acid batteries	unit	22	0	22
14	Clinic Waste	Kg	9.4	0	9.4
15	Lithium-ion batteries	unit	7	0	7
16	Empty used oil drum/container	Drum (200 L)	2	0	2

3.4 Community Waste Management

3.4.1 Community Recycling Programme

In February 2019, a total of 2,614 kg of recyclable waste was recorded at the Community Waste Bank, an increase of 585 kg compared to January 2019.

Table 3-12: Types and Amounts of Recyclable Waste Traded at the Community Waste Bank

Types of Waste	Unit	Remaining in Jan 2019	Additions in Feb 2019	Sold	Remaining in Feb 2019
Scrap metal	kg	9	34.5	0	43.5
Glass bottles	kg	1,390.5	285	0	1,675.5
Paper/cardboard	kg	521	180	0	701
Aluminium cans	kg	12	28	0	40
Plastic bottles	kg	96.5	57.5	0	154
Total	**kg**	**2,029**	**585**	**0**	**2,614**

3.4.2 Community Solid Waste Management

In February 2019, a total of 103 m^3 of solid waste was collected from Phouhomxay, Thahuea and Hat Gniun Villages. The solid waste was transported to Houay Soup Landfill where recyclable materials were segregated before being disposed of at the landfill.

During 06-07 February 2019, NNP1-EMO and the Houay Soup Landfill Contractor conducted a community consultation on waste management for host villages (Thaheau and Hat Gnuin village) and Phouhomxay village which included role and responsibility of the villagers for waste separation and temporary storage, scope of solid waste collection and Houay Soup Landfill operation by the Contractor as well as waste collection operation schedule.

3.5 Watershed and Biodiversity Management

3.5.1 Watershed Management

3.5.1.1 Watershed Management Plan

NNP1PC continues with further improvement of the Lao version of the Plan in-house. NNP1PC also discussed with the Department of Forestry (DOF), Ministry of Agriculture and Forestry (MAF) on a final consultation workshop at the central level and noted that Vice Minister of MAF will be available to chair the workshop on 13 March 2019.

NNP1PC continues to work with Xaysomboun and Bolikhamxay WRPOs to finalize the draft AIP 2019. The internal discussion between NNP1PC and WRPOs was scheduled during 6-8 March 2019 and the final draft will be presented during the final consultation workshop on 13 March 2019.

The operation of checkpoints in both Provinces continued in February 2019. The checkpoints made 596 records of people accessing the main reservoir. Out of these, a total of 492 records of people from Houayxay Village (Hom District, Xaysomboun Province) and 104 records of people from Nahanh Village (Bolikhan District, Bolikhamxay Province). The checkpoint in Nahanh Village will not be continued from March 2019 and onward due to

end of pre-WMP funding for Bolikhamxay Province. Bolikhamxay Provincial WRPO removed the checkpoint structure at the end of February 2019.

The main reasons why people access the reservoir include fishing and hunting (106 records), agriculture (112 records), livestock raising (161 records) and other purpose (216 records). The checkpoint in Pou Village recorded 536 boats entering the reservoir and 543 boats leaving the reservoir. Military staff appointed at the checkpoints are not law enforcement officers for Forestry Law and Wildlife and Aquatic Animal Law. Thus, they are only responsible for security checks and report the incidents to the WRPO for further actions. An approval of the WMP will be needed to provide the basis for the preparation and implementation of the AIP 2019 that will include full patrolling activities in the TPZs and the reservoir.

3.5.1.2 PREPARATION OF PROVINCIAL REGULATION FOR THE WATERSHED MANAGEMENT

Xaysomboun Provincial WRPO submitted the improved Regulation to Xaysomboun Provincial Assembly for further review and certification on 05 February 2019. Once approved by the Xaysomboun Provincial Assembly, the Regulation will be further submitted for Provincial Governor's review and signature.

3.5.2 Biodiversity Offset Management

3.5.2.1 PREPARATION OF BIODIVERSITY OFFSET MANAGEMENT PLAN

ADB provided further comments on the improved Biodiversity Offset Management Plan (BOMP) in the first week of February 2019. NNP1PC together with its Biodiversity Consultant continued improving the plan addressing comments from ADB, IAP and BAC, in particular with respect to developing the intervention logic comprising conservation objectives, threat reduction objectives expected results and management activities in a log frame layout. The improved Plan is expected to be resubmitted to ADB, IAP and BAC in the beginning of March 2019.

3.5.2.2 IMPLEMENTATION OF PRE-BIODIVERSITY OFFSET MANAGEMENT PLAN (BOMP)

The Pre-BOMP2B proposal was approved by ADB and agreed by BOMC at the end of September 2018. A total of USD 88,578 was disbursed in September 2018 for the continuation of the checkpoint operation and patrolling from September 2018 – March 2019.

Two patrolling teams with a total of 18 people conducted forest patrolling for 16 days in both Viengthong and Xaychamphone Districts. The patrolling covered 13 biodiversity areas within the NC-NX Offset Site in these Districts. The main threats found in the area are wildlife hunting and unregulated fishing by local villagers. Five temporary hunting camps, eigh unregulated fishing activities, 41 small wire snares, 26 large wire snare, and 17 log trap were recorded by Xaychamphone District's patrolling team. In addition, one Serow (approximate weight of 30 kg) and one Muntjac (approximat weight of 15 kg) were confiscated with fines and written warning made to the offenders by this team. A total of one temporary hunting camp and one unregulated fishing camp were recored by Viegthong District's patrolling team.

BOMC members conducted a site visit and monitoring of the pre-BOMP activities during the first week of February 2019. The BOMC team was led by the Deputy Head of the Bolikhamxay Provincial Military and accompanied by Vice Governor of Viengthong District and the Chairman of the State Audit of Viengthong District. The main puposes of the visit is 1) to obtain the updates on the overall progress of pre-BOMP activities and provide advice to enhance the management of NC-NX Offset Site and; 2) to have discussions with relevant GOL offices and communities at the three target villages in Viengthong District particularly on preventing a forest fire during the dry season, reducing or stopping the slash and burn farming practices, and urging the local villagers to be more aware and be part of the biodiversity protection inside NC-NX especially for the proposed TPZ areas.

It is noted from the recommendations of the IAP and ADB Mission in December 2018, the discussion with the Head of Bolikhamxay PAFO in January 2019, and as further advised by NNP1PC Management that the AIP2019 should be ready for implementation immediately after the pre-BOMP2B funding is over to avoid any gaps in implementation. Thus, Bolikhamxay Provincial BOMU together with NNP1 EMO have started the preparation of AIP2019 and the intial draft was ready at the end of February for further review by NNP1PC.

3.6 FLOATING DEBRIS REMOVAL

The floating debris removal work contract is being prepared and negotiated. The work will be resumed in March 2019 after the contract is signed.

4. FISHERY MONITORING

Two species groups and three species dominated the fish catch by weight in January as listed in ***Table 4-1.*** These species are classified as Least Concern (LC) according to the IUCN Red List of Threatened Species[2].

[2] The IUCN Red List of Threatened Species is the world's most comprehensive inventory and classification of threatened species. The Red List classifies species into nine groups: Extinct (EX), Extinct in the wild (EW), Critically endangered (CR), Endangered (EN), Vulnerable (VU), Near threatened (NT), Least concern (LC), Data deficient (DD), and Not evaluated (NE). The term "Threatened" includes Critically Endangered, Endangered, and Vulnerable.

Table 4-1: ***Fish Species dominating the Fish Catch in January 2019***

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
Poropuntius normani, Poropuntius laoensis	ปาจาด	376.5	LC
Systomus orphoides	ปาปึก	156.3	LC
Mystacoleucus atridorsalis, Mystacoleucus marginatus	ปาหูดหนาม	120.7	LC
Channa striata	ปาถ่อ	115.4	LC
Clarias batrachus	ปาดุก	103.5	LC

The recorded catch of Threatened and Near Threatened species (IUCN Red List classification) in January 2019 is presented in ***Table 4-2***. The list includes three species that are classified as Vulnerable (VU) species and four Near Threatened (NT) species.

Table 4-2: ***Threatened Species of January 2019 Fish Catch***

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
Bangana behri	ปาม้อม	28.4	VU
Cirrhinus cirrhosus	ปามอมจัน/ ปาแกง	4.5	VU
Cirrhinus molitorella	ปาแกง	4.3	NT
Neolissochilus stracheyi	ปาสอง	7.8	NT
Ompok bimaculatus	ปาเผือม	9.9	NT
Onychostoma gerlachi	ปาถิง	40.4	NT
Scaphognathops bandanensis	ปาอวนไฟ	23.5	VU

The total recorded monthly fish catch for the downstream and upstream fishing households and the Mekong control group involved in the monitoring programme from July 2015 to January 2019 is presented in ***Figure 4-1.*** Note that the upstream fish catch excludes the fish catch from the fishing households in Zone 2LR because these households were resettled during Q4-2017.

Figure 4-1: ***Total Recorded Monthly Fish Catch July 2015-January 2019***

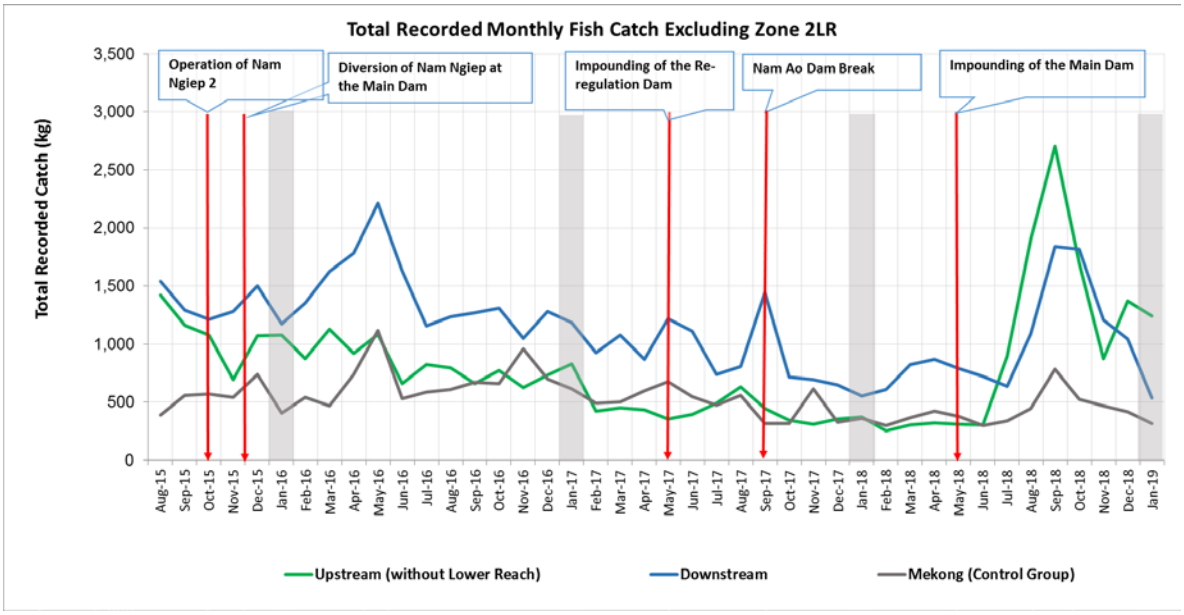
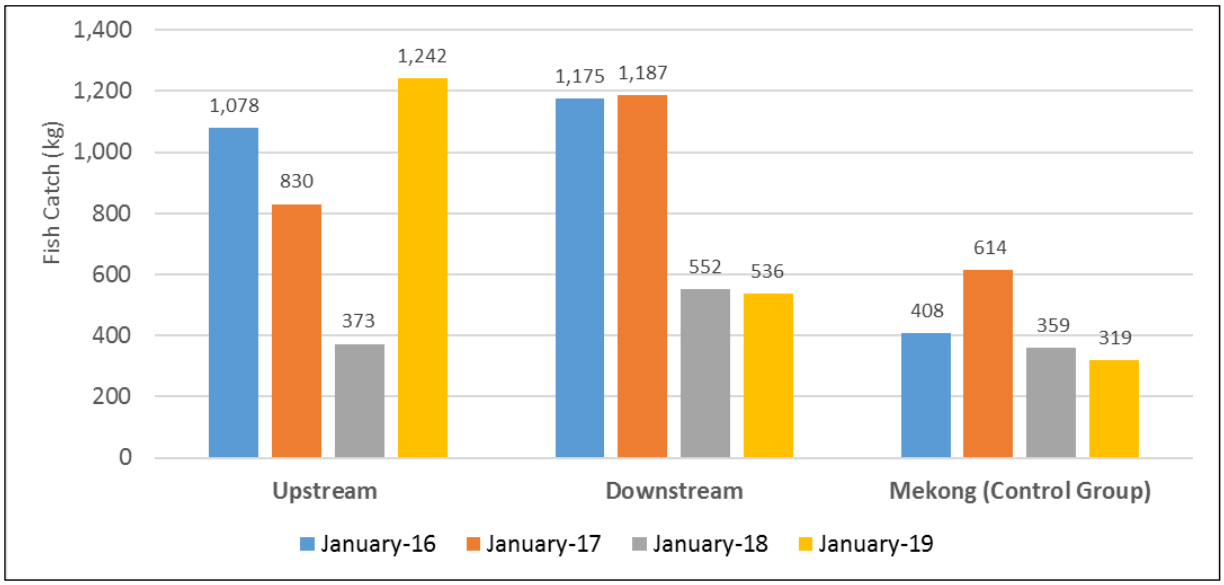


Table 4-3 and ***Figure 4-2*** show the total recorded fish catch for January 2016, January 2017, January 2018, and January 2019 in the upstream (excluding Zone 2LR) and downstream communities and the Mekong control group. The total fish catch data represents the total fish supply provided by the involved fishing households.

Table 4-3: ***Total Recorded Fish Catch by Upstream (Excluding Zone 2LR), Downstream and Mekong Control Group Fishing Households in January 2016, January 2017, January 2018, and January 2019***

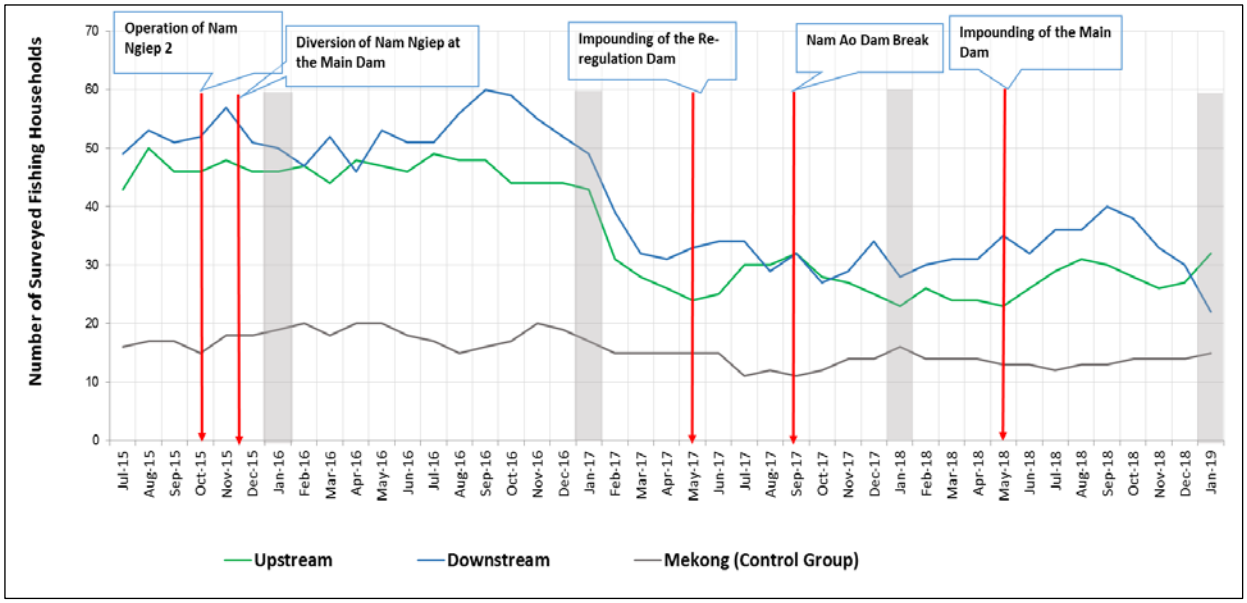
Fishing Zone	January 2016 (kg)	January 2017 (kg)	January 2018 (kg)	January 2019 (kg)
Upstream	1,078	830	373	1,242
Downstream	1,175	1,187	552	536
Mekong Control Group	408	614	359	319

Figure 4-2: ***Total Recorded Fish Catch in November by Upstream (Excluding Zone 2LR), Downstream and Mekong Control Group Fishing Households***



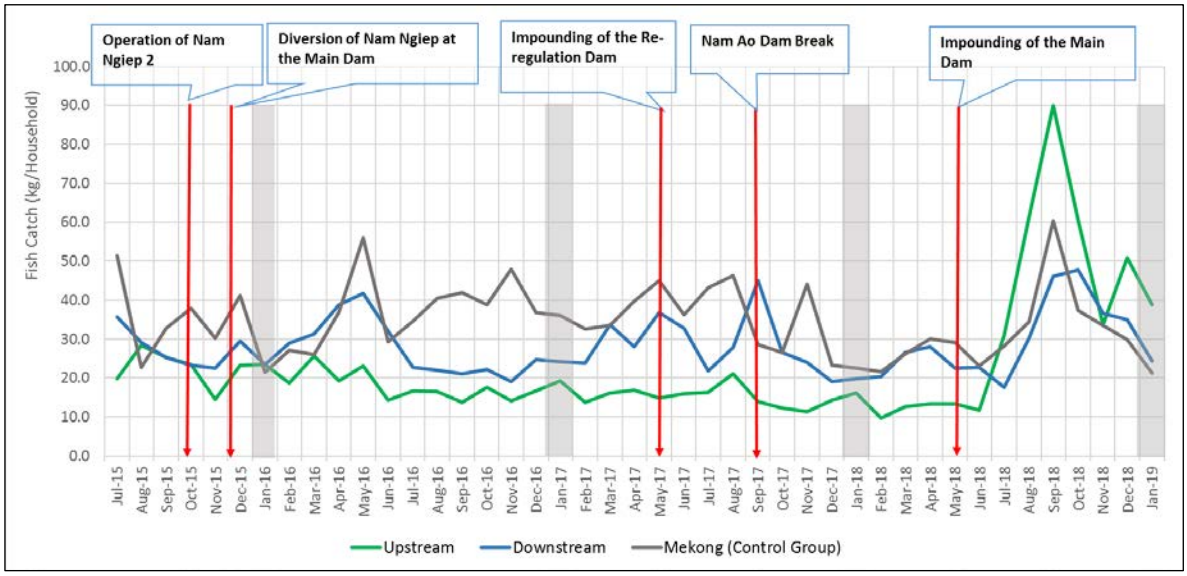
The numbers of fishing households involved in the fish catch monitoring programme are displayed in ***Figure 4-3***.

Figure 4-3: ***Number of Fishing Households Involved in the Fish Catch Monitoring Programme***



The mean monthly household fish catch from July 2015 to January 2019 for the upstream (excluding Zone 2LR) and downstream communities, and the Mekong control group are presented in ***Figure 4-4***.

Figure 4-4: ***Mean Monthly Household Fish Catch without Zone 2LR***



The mean household fish catch for January 2016, January 2017, January 2018 and January 2019 in the upstream (excluding Zone 2LR) and downstream communities, and the Mekong control group are displayed in *Table* ***4-4***.

Table 4-4: ***Mean Monthly Household Fish Catch in the Upstream and Downstream Communities Excluding Zone 2LR in January***

Fishing Zone	January 2016 (kg)	January 2017 (kg)	January 2018 (kg)	January 2019 (kg)
Upstream	23.4	19.3	16.2	38.8
Downstream	23.5	24.2	19.7	24.3
Mekong Control Group	21.5	36.1	22.5	21.2

The mean monthly fish catch per household per fishing day are displayed in ***Figure 4-5***, and the mean fish catch per household per fishing day for January 2016, January 2017, January 2018 and January 2019 are shown in ***Table 4-5***.

Figure 4-5: ***Mean Household Fish Catch per Fishing Day***

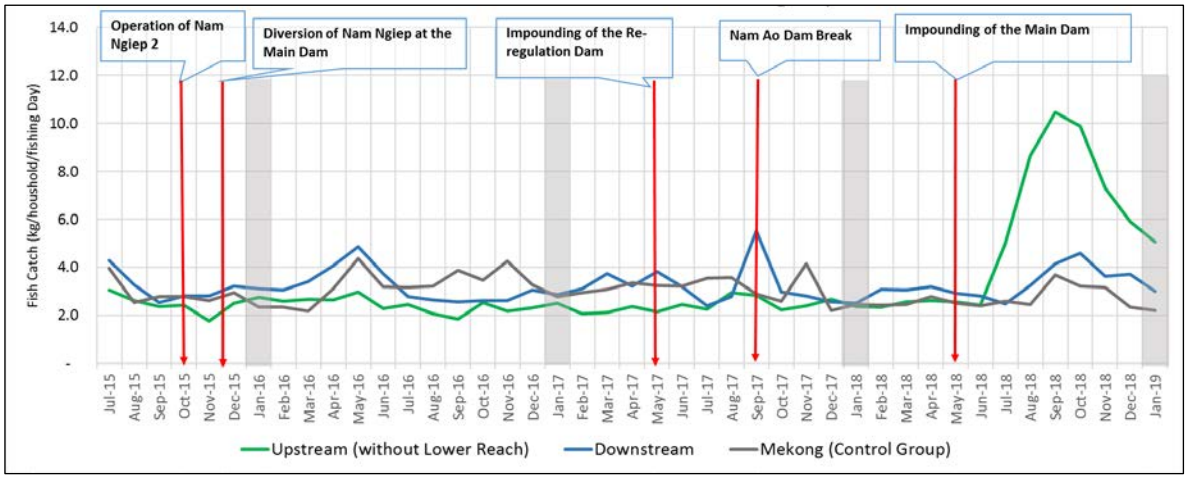


Table 4-5: ***Mean Household Fish Catch per Fishing Day in January 2019***

Fishing Zone	January 2016 (kg)	January 2017 (kg)	January 2018 (kg)	January 2019 (kg)
Upstream	2.8	2.52	2.37	5.07
Downstream	3.1	2.85	2.50	2.99
Mekong (Control Group)	2.3	2.79	2.46	2.20

ANNEXES

ANNEX A: Results of Surface Water Quality Analyses

Table A- 1: Results of Main Reservoir, Re-regulation Reservoir and Surface Water (Nam Ngiep River) Quality Monitoring

		Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08
Date	Parameters (Unit)	Guideline												
2-Feb-19	pH	5.0 - 9.0						7.89			7.81			
4-Feb-19	pH	5.0 - 9.0					7.98	8.19						
5-Feb-19	pH	5.0 - 9.0	8.17	7.9	7.52	7.8								
6-Feb-19	pH	5.0 - 9.0							8.74	8.09	7.97	7.89	8	7.67
9-Feb-19	pH	5.0 - 9.0						7.89			7.87			
11-Feb-19	pH	5.0 - 9.0					7.71	7.79						
12-Feb-19	pH	5.0 - 9.0		7.99	7.78	7.7								
13-Feb-19	pH	5.0 - 9.0							7.98	8.02	8.36	7.71	8.02	8.28
16-Feb-19	pH	5.0 - 9.0						7.97			7.93			
18-Feb-19	pH	5.0 - 9.0					8.02	7.75						
19-Feb-19	pH	5.0 - 9.0	8.02	8.17	7.8	7.91								
20-Feb-19	pH	5.0 - 9.0							8.07	8.03	8.27	7.27	6.83	6.93
23-Feb-19	pH	5.0 - 9.0						8.29			8.3			
25-Feb-19	pH	5.0 - 9.0					8.22	7.91						
26-Feb-19	pH	5.0 - 9.0		8.11	7.85	8.06								
27-Feb-19	pH	5.0 - 9.0							7.9	7.98	7.89	7.78	6.67	6.78
2-Feb-19	Sat. DO (%)							87			108.4			
4-Feb-19	Sat. DO (%)						90	85.5						
5-Feb-19	Sat. DO (%)		103.2	94.7	84.3	84.7								
6-Feb-19	Sat. DO (%)								99.9	92.6	103.5	94.1	99.5	101.1
9-Feb-19	Sat. DO (%)							96.3			107.4			
11-Feb-19	Sat. DO (%)						72.9	78.6						
12-Feb-19	Sat. DO (%)			75	35.3	78.6								
13-Feb-19	Sat. DO (%)								103.3	91.6	96	89.9	97.3	101.2
16-Feb-19	Sat. DO (%)							87.5			104.5			
18-Feb-19	Sat. DO (%)						91.2	90.3						
19-Feb-19	Sat. DO (%)		103	104.2	71.6	99.2								
20-Feb-19	Sat. DO (%)								87.6	81.1	100.1	99.9	97.7	96.2
23-Feb-19	Sat. DO (%)							91.8			103.4			
25-Feb-19	Sat. DO (%)						85.6	89.9						
26-Feb-19	Sat. DO (%)			94.5	86.1	88.5								
27-Feb-19	Sat. DO (%)								92.2	87.7	102.2	99.6	97.5	97.4
2-Feb-19	DO (mg/l)	<6.0						7.06			8.69			
4-Feb-19	DO (mg/l)	<6.0					7.42	7.04						
5-Feb-19	DO (mg/l)	<6.0	8.37	7.66	7.09	7.11								
6-Feb-19	DO (mg/l)	<6.0							8.63	7.98	8.49	7.75	7.97	7.99
9-Feb-19	DO (mg/l)	<6.0						7.65			8.72			
11-Feb-19	DO (mg/l)	<6.0					6.17	6.51						
12-Feb-19	DO (mg/l)	<6.0		6.16	2.94	6.94								
13-Feb-19	DO (mg/l)	<6.0							9.52	8.44	7.75	7.33	7.63	7.82
16-Feb-19	DO (mg/l)	<6.0						6.78			8.36			
18-Feb-19	DO (mg/l)	<6.0					7.43	7.42						
19-Feb-19	DO (mg/l)	<6.0	8.22	8.35	5.78	8.09								
20-Feb-19	DO (mg/l)	<6.0							7.19	6.65	8.06	8.14	7.79	7.32
23-Feb-19	DO (mg/l)	<6.0						6.99			8.04			
25-Feb-19	DO (mg/l)	<6.0					6.83	7.23						
26-Feb-19	DO (mg/l)	<6.0		7.5	6.93	7.15								
27-Feb-19	DO (mg/l)	<6.0							7.6	7.07	7.97	7.89	7.61	7.4
2-Feb-19	Conductivity (µs/cm)							52.6			51.7			
4-Feb-19	Conductivity (µs/cm)						72	69						

		Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08
Date	Parameters (Unit)	Guideline												
5-Feb-19	Conductivity (µs/cm)		69.1	91	85	77								
6-Feb-19	Conductivity (µs/cm)								78	76	52.7	55.4	56.1	57.2
9-Feb-19	Conductivity (µs/cm)							50.5			52.9			
11-Feb-19	Conductivity (µs/cm)						73	69						
12-Feb-19	Conductivity (µs/cm)			90	84	82								
13-Feb-19	Conductivity (µs/cm)								79	80	54.2	56.2	57.4	59.2
16-Feb-19	Conductivity (µs/cm)							50.3			55.1			
18-Feb-19	Conductivity (µs/cm)						69	69						
19-Feb-19	Conductivity (µs/cm)		65.7	89	83	70								
20-Feb-19	Conductivity (µs/cm)								70	71	51.1	54.9	51.7	52.5
23-Feb-19	Conductivity (µs/cm)							50.5			51.1			
25-Feb-19	Conductivity (µs/cm)						69	69						
26-Feb-19	Conductivity (µs/cm)			88	82	70								
27-Feb-19	Conductivity (µs/cm)								71	71	51.9	53.8	52.9	52.2
2-Feb-19	TDS (mg/l)							26.3			25.85			
4-Feb-19	TDS (mg/l)						36	34.5						
5-Feb-19	TDS (mg/l)		34.55	45.5	42.5	38.5								
6-Feb-19	TDS (mg/l)								38.5	38	26.35	27.62	28.05	28.6
9-Feb-19	TDS (mg/l)							25.22			26.5			
11-Feb-19	TDS (mg/l)						36.5	34.5						
12-Feb-19	TDS (mg/l)			45	42	41								
13-Feb-19	TDS (mg/l)								39.5	40	27.1	28.1	28.7	29.6
16-Feb-19	TDS (mg/l)							25			27.5			
18-Feb-19	TDS (mg/l)						34.5	34.5						
19-Feb-19	TDS (mg/l)		33	44.5	41.5	35								
20-Feb-19	TDS (mg/l)								25	25.43	25.55	27.45	25.85	26.25
23-Feb-19	TDS (mg/l)							25.25			25.55			
25-Feb-19	TDS (mg/l)						34.5	34.5						
26-Feb-19	TDS (mg/l)			44	41	35								
27-Feb-19	TDS (mg/l)								35.5	35.5	25.9	26.9	26.4	26
2-Feb-19	Temperature (°C)							24.1			23.2			
4-Feb-19	Temperature (°C)						25.1	25.44						
5-Feb-19	Temperature (°C)		24	25.85	24.48	24.22								
6-Feb-19	Temperature (°C)								22.68	22.23	24.3	24.1	25.6	26.3
9-Feb-19	Temperature (°C)							25.2			24.8			
11-Feb-19	Temperature (°C)						23.75	25.63						
12-Feb-19	Temperature (°C)			25.57	24.86	21.74								

		Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08
Date	Parameters (Unit)	Guideline												
13-Feb-19	Temperature (°C)								19.69	19.23	25.4	25	27.1	27.8
16-Feb-19	Temperature (°C)							25.1			25.5			
18-Feb-19	Temperature (°C)						25.78	24.95						
19-Feb-19	Temperature (°C)		24.6	26.88	26.45	25.72								
20-Feb-19	Temperature (°C)								25	25.43	26.4	24.8	25.9	28.4
23-Feb-19	Temperature (°C)							27.3			27.1			
25-Feb-19	Temperature (°C)						26.82	26.49						
26-Feb-19	Temperature (°C)			27.24	26.41	26.48								
27-Feb-19	Temperature (°C)								25.16	26.26	26.9	26.1	26.9	28.2
2-Feb-19	Turbidity (NTU)							1.54			16.22			
4-Feb-19	Turbidity (NTU)						1.16	1.43						
5-Feb-19	Turbidity (NTU)		9.1	2.06	1.58	1.57								
6-Feb-19	Turbidity (NTU)								6.68	2.97	6.1	5.38	4.4	5.4
9-Feb-19	Turbidity (NTU)							2.04			6.4			
11-Feb-19	Turbidity (NTU)						1.77	2.11						
12-Feb-19	Turbidity (NTU)			2.08	2.24	1.97								
13-Feb-19	Turbidity (NTU)								3.42	4.04	3.53	3.38	2.17	3.68
16-Feb-19	Turbidity (NTU)							1.38			4.36			
18-Feb-19	Turbidity (NTU)						0.84	0.83						
19-Feb-19	Turbidity (NTU)		7.19	1.15	1.6	0.89								
20-Feb-19	Turbidity (NTU)								3.02	2.98	4.71	5.12	5.73	8.42
23-Feb-19	Turbidity (NTU)							0.89			3.03			
25-Feb-19	Turbidity (NTU)						1.54	1.87						
26-Feb-19	Turbidity (NTU)			1.95	2.07	1.65								
27-Feb-19	Turbidity (NTU)								4.3	4.16	6.29	5.86	5.91	7.92
4-Feb-19	TSS (mg/l)						<5	<5						
5-Feb-19	TSS (mg/l)		22.5	<5	<5	<5								
6-Feb-19	TSS (mg/l)								19.34	6.11	9.39	6.56	<5	8.77
11-Feb-19	TSS (mg/l)							<5						
13-Feb-19	TSS (mg/l)								6.98	<5	<5			
18-Feb-19	TSS (mg/l)							<5						
20-Feb-19	TSS (mg/l)								16.41	20	29.58			
4-Feb-19	BOD5 (mg/l)	<1.5					<1	1.54						
5-Feb-19	BOD5 (mg/l)	<1.5	<1	1.1	<1	<1								

		Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08
Date	Parameters (Unit)	Guideline												
6-Feb-19	BOD5 (mg/l)	<1.5							1.1	<1	1.08	1.13	1.1	1.12
11-Feb-19	BOD5 (mg/l)	<1.5						<1						
13-Feb-19	BOD5 (mg/l)	<1.5							<1	<1	<1			
18-Feb-19	BOD5 (mg/l)	<1.5						<1						
20-Feb-19	BOD5 (mg/l)	<1.5							<1	<1	<1			
4-Feb-19	COD (mg/l)	<5					6.1	5.3						
5-Feb-19	COD (mg/l)	<5	6.6	11	5.3	10.4								
6-Feb-19	COD (mg/l)	<5							6.1	5.7	7.8	8.4	<5	6.9
4-Feb-19	NH_3-N (mg/l)	<0.2					<0.2	<0.2						
5-Feb-19	NH_3-N (mg/l)	<0.2	<0.2	<0.2	<0.2	<0.2								
6-Feb-19	NH_3-N (mg/l)	<0.2							<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
4-Feb-19	NO_3-N (mg/l)	<5					<0.02	<0.02						
5-Feb-19	NO_3-N (mg/l)	<5	0.04	<0.02	<0.02	<0.02								
6-Feb-19	NO_3-N (mg/l)	<5							<0.02	<0.02	<0.02	<0.02	<0.02	0.03
4-Feb-19	Faecal coliform (MPN/100 ml)	<1,000					23	23						
5-Feb-19	Faecal coliform (MPN/100 ml)	<1,000	130	34	240	33								
6-Feb-19	Faecal coliform (MPN/100 ml)	<1,000							5	0	2	8	17	34
11-Feb-19	Faecal coliform (MPN/100 ml)	<1,000						7						
13-Feb-19	Faecal coliform (MPN/100 ml)	<1,000							4	2	0			
18-Feb-19	Faecal coliform (MPN/100 ml)	<1,000						13						
20-Feb-19	Faecal coliform (MPN/100 ml)	<1,000							2	5	14			
4-Feb-19	Total Coliform (MPN/100 ml)	<5,000					49	33						
5-Feb-19	Total Coliform (MPN/100 ml)	<5,000	540	130	350	33								
6-Feb-19	Total Coliform (MPN/100 ml)	<5,000							8	0	13	26	49	350
11-Feb-19	Total Coliform (MPN/100 ml)	<5,000						7						
13-Feb-19	Total Coliform (MPN/100 ml)	<5,000							17	14	49			
18-Feb-19	Total Coliform (MPN/100 ml)	<5,000						22						
20-Feb-19	Total Coliform (MPN/100 ml)	<5,000							17	22	130			
4-Feb-19	Phytoplankton Biomass (g dry wt/m^3)						0.2	0.3						
5-Feb-19	Phytoplankton Biomass (g dry wt/m^3)			0.4	0.3	0.5								
6-Feb-19	Phytoplankton Biomass (g dry wt/m^3)								23.1	4.4				

	Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08
Date	**Parameters (Unit)**	**Guideline**											
4-Feb-19	Total Phosphorus (mg/l)						<0.01	<0.01					
5-Feb-19	Total Phosphorus (mg/l)			<0.01	<0.01	<0.01							
6-Feb-19	Total Phosphorus (mg/l)								<0.01	<0.01			
4-Feb-19	Total Dissolved Phosphorus (mg/l)						<0.01	<0.01					
5-Feb-19	Total Dissolved Phosphorus (mg/l)			<0.01	<0.01	<0.01							
6-Feb-19	Total Dissolved Phosphorus (mg/l)								<0.01	<0.01			
4-Feb-19	TOC (mg/l)						2.35	2.46					
5-Feb-19	TOC (mg/l)			3.73	2.45	2.29							
6-Feb-19	TOC (mg/l)								2.75	2.49			
4-Feb-19	Hydrogen Sulfide (mg/l)							<0.02					
6-Feb-19	Hydrogen Sulfide (mg/l)								<0.02	<0.02			

Table A- 1: Results of Surface Water Quality Monitoring in Nam Chian, Nam Phouan, Nam Xao and Nam Houay Soup

	Station Code	NCH01	NPH01	NXA01	NHS01
Date	**Parameters (Unit)**	**Guideline**			
5-Feb-19	pH	5.0 - 9.0	8.76	8.48	
6-Feb-19	pH	5.0 - 9.0			7.87	7.78
12-Feb-19	pH	5.0 - 9.0		8.62	
13-Feb-19	pH	5.0 - 9.0			7.76	7.57
19-Feb-19	pH	5.0 - 9.0	8.22	8.49	
20-Feb-19	pH	5.0 - 9.0			7.28	6.81
26-Feb-19	pH	5.0 - 9.0		8.39	
27-Feb-19	pH	5.0 - 9.0			7.82	7.18
5-Feb-19	Sat. DO (%)		103.8	97.6	
6-Feb-19	Sat. DO (%)				87.6	94.3
12-Feb-19	Sat. DO (%)			92.5	
13-Feb-19	Sat. DO (%)				82.1	83.1
19-Feb-19	Sat. DO (%)		100.4	112.7	
20-Feb-19	Sat. DO (%)				82.3	74
26-Feb-19	Sat. DO (%)			93.4	
27-Feb-19	Sat. DO (%)				81.2	97
5-Feb-19	DO (mg/l)	<6.0	8.81	9.06	
6-Feb-19	DO (mg/l)	<6.0			7.2	7.82
12-Feb-19	DO (mg/l)	<6.0		8.9	

		Station Code	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline				
13-Feb-19	DO (mg/l)	<6.0			6.72	7.06
19-Feb-19	DO (mg/l)	<6.0	8.29	10.12		
20-Feb-19	DO (mg/l)	<6.0			6.71	6.09
26-Feb-19	DO (mg/l)	<6.0		8.21		
27-Feb-19	DO (mg/l)	<6.0			6.36	7.72
5-Feb-19	Conductivity (µs/cm)		26.1	71		
6-Feb-19	Conductivity (µs/cm)				117	56.1
12-Feb-19	Conductivity (µs/cm)			75		
13-Feb-19	Conductivity (µs/cm)				122.2	45.6
19-Feb-19	Conductivity (µs/cm)		32.5	71		
20-Feb-19	Conductivity (µs/cm)				94.1	61.5
26-Feb-19	Conductivity (µs/cm)			68		
27-Feb-19	Conductivity (µs/cm)				116.2	40.3
5-Feb-19	TDS (mg/l)		13.05	35.5		
6-Feb-19	TDS (mg/l)				58.5	28
12-Feb-19	TDS (mg/l)			37.5		
13-Feb-19	TDS (mg/l)				61.1	37.8
19-Feb-19	TDS (mg/l)		16	35.5		
20-Feb-19	TDS (mg/l)				24.8	30.75
26-Feb-19	TDS (mg/l)			34		
27-Feb-19	TDS (mg/l)				58	20
5-Feb-19	Temperature (°C)		21.3	18.94		
6-Feb-19	Temperature (°C)				24.2	24.1
12-Feb-19	Temperature (°C)			17.25		
13-Feb-19	Temperature (°C)					
19-Feb-19	Temperature (°C)		22.6	20.69		
20-Feb-19	Temperature (°C)				24.8	24.3
26-Feb-19	Temperature (°C)			21.86		
27-Feb-19	Temperature (°C)				26.8	25.3
5-Feb-19	Turbidity (NTU)		5.39	2.94		
6-Feb-19	Turbidity (NTU)				3.22	4.2
12-Feb-19	Turbidity (NTU)			3.14		
13-Feb-19	Turbidity (NTU)				3.12	3.58
19-Feb-19	Turbidity (NTU)		3.43	3.35		
20-Feb-19	Turbidity (NTU)				9.25	3.42
26-Feb-19	Turbidity (NTU)			13.55		
27-Feb-19	Turbidity (NTU)				4.12	5.79
5-Feb-19	TSS (mg/l)		8.44	<5		
6-Feb-19	TSS (mg/l)				<5	<5
5-Feb-19	BOD_5 (mg/l)	<1.5	<1	<1		
6-Feb-19	BOD_5 (mg/l)	<1.5			1.01	1.1
5-Feb-19	COD (mg/l)	<5	<5	<5		
6-Feb-19	COD (mg/l)	<5			11	6.1
5-Feb-19	NH_3-N (mg/l)	<0.2	<0.2	<0.2		
6-Feb-19	NH_3-N (mg/l)	<0.2			<0.2	<0.2
5-Feb-19	NO_3-N (mg/l)	<5	0.03	0.03		
6-Feb-19	NO_3-N (mg/l)	<5			0.03	0.03
5-Feb-19	Faecal coliform (MPN/100 ml)	<1,000	240	22		
6-Feb-19	Faecal coliform (MPN/100 ml)	<1,000			22	17
5-Feb-19	Total Coliform (MPN/100 ml)	<5,000	240	79		
6-Feb-19	Total Coliform (MPN/100 ml)	<5,000			79	110

ANNEX B: Results of Effluent Analyses

Table B- 1: Results of Camp Effluents in February 2019

	Site Name	Owner's Site Office and Village		Obayashi Camp		Song Da 5 Camp No.1	
	Station Code	EF01		EF02		EF07	
	Date	01-Feb-19	15-Feb-19	01-Feb-19	15-Feb-19	01-Feb-19	15-Feb-19
Parameters (Unit)	**Guideline**						
pH	6.0 - 9.0	7.18	7.04	7.6	7.47	7.57	7.58
Sat. DO (%)		37.3	46.3	80.7	75.6	55.8	74.7
DO (mg/l)		2.96	3.55	6.46	9.83	4.66	6.01
Conductivity (µs/cm)		487	408	417	409	1,028	978
TDS (mg/l)		243.5	204	208.5	204.5	514	489
Temperature (°C)		26	27.8	25.8	27.5	23.5	25.4
Turbidity (NTU)		1.67	1.85	7.62	6.69	20.36	14.24
TSS (mg/l)	<50	<5	<5	7.29	6.25	6.92	7.35
BOD_5 (mg/l)	<30	<6	45.55	<6	<6	<6	69.56
COD (mg/l)	<125	<25	<25	39.5	30.8	64.1	54.9
NH_3-N (mg/l)	<10.0	16.5	18.5	13.4	13.3	21.7	19.9
Total Nitrogen (mg/l)	<10.0	17.1	19.3	16.1	14.1	23.5	21.1
Total Phosphorus (mg/l)	<2	0.38	0.42	0.96	1.04	1.06	1.1
Oil & Grease (mg/l)	<10.0	<1		<1		<1	
Total coliform (MPN/100 ml)	<400	1,600	170	0	0	2	2,200
Faecal Coliform (MPN/100 ml)	<400	220	33	0	0	0	1,600
Effluent Discharge Volume (L/mn)		12	6	10	6	12	20
Chlorination Dosing Rate (ml/mn)		n/a	n/a	61	225	30	12
Residual Chlorine (mg/l)	<1.0	n/a	n/a	0.38	0.75	0.32	0.08

	Site Name	SongDa5 Camp No.2		Zhefu Camp		V&K Camp	
	Station Code	EF08		EF09		EF10	
	Date	01-Feb-19	15-Feb-19	01-Feb-19	15-Feb-19	01-Feb-19	15-Feb-19
Parameters (Unit)	**Guideline**						
pH	6.0 - 9.0			8.02		7.89	7.4
Sat. DO (%)				32.2		59.1	87
DO (mg/l)		No sampling due to the last pond of wetland system was dried.		2.91	No sampling due to no inflow into chlorination tank	4.97	6.87
Conductivity (µs/cm)				1,162		370	601
TDS (mg/l)				581		158	300
Temperature (°C)				24.5		23.4	26.4
Turbidity (NTU)				13.48		3.49	15.21
TSS (mg/l)	<50			42.52		11.11	15.33
BOD5 (mg/l)	<30			<6		7.2	9.63
COD (mg/l)	<125			99.8		31.3	30.8
NH3-N (mg/l)	<10.0			28.8		6.5	3
Total Nitrogen (mg/l)	<10.0			30.4		8.37	8.1
Total Phosphorus (mg/l)	<2			1.37		0.52	0.16
Oil & Grease (mg/l)	<10.0			<1		<1	
Total coliform (MPN/100 ml)	<400			0		220	0

	Site Name	SongDa5 Camp No.2		Zhefu Camp		V&K Camp	
	Station Code	EF08		EF09		EF10	
	Date	01-Feb-19	15-Feb-19	01-Feb-19	15-Feb-19	01-Feb-19	15-Feb-19
Parameters (Unit)	**Guideline**						
Faecal Coliform (MPN/100 ml)	<400			0		11	0
Effluent Discharge Volume (L/mn)				4.2		4.6	2.6
Chlorination Dosing Rate (ml/mn)				3.1		84	33
Residual Chlorine (mg/l)	<1.0			1.89		0.08	0.29

	Site Name	HM Main Camp		IHI Main Camp		Lilama10 Camp		IHI Field Shop 276 Camp	
	Station Code	EF13		EF14		EF17		EF18	
	Date	01-Feb-19	15-Feb-19	01-Feb-19	15-Feb-19	01-Feb-19	15-Feb-19	01-Feb-19	15-Feb-19
Parameters (Unit)	**Guideline**								
pH	6.0 - 9.0	7.22	7.07	6.81	6.68			7.14	6.83
Sat. DO (%)		62.2	58.8	41.2	44.3			79.5	54.2
DO (mg/l)		5.08	4.6	3.38	3.48			6.51	4.26
Conductivity (µs/cm)		662	660	910	478			310	294
TDS (mg/l)		331	330	455	239			155	147
Temperature (°C)		24.8	26.8	24.6	27.1			24.7	26.7
Turbidity (NTU)		39.87	43.11	27.75	9.86			2.91	10.61
TSS (mg/l)	<50	34.75	18.18	43.75	10.41			<5	9.13
BOD_5 (mg/l)	<30	<6	95.7	21.6	<6			<6	15.78
COD (mg/l)	<125	143	155	154	35.4			<25	29.4
NH_3-N (mg/l)	<10.0	21.8	24	<0.2	10.6			<0.2	1.6
Total Nitrogen (mg/l)	<10.0	27.4	25	0.64	12.7			0.7	4.96
Total Phosphorus (mg/l)	<2	1.06	1.24	0.4	0.96			0.08	0.25
Oil & Grease (mg/l)	<10.0	11		9				<1	
Total coliform (MPN/100 ml)	<400	0	0	0	0			0	6.8
Faecal Coliform (MPN/100 ml)	<400	0	0	0	0			0	0
Effluent Discharge Volume (L/mn)		4.2	4.2	4.2	4.2			3	1.6
Chlorination Dosing Rate (ml/mn)		3.1	3.1	3.1	3.1			20	33
Residual Chlorine (mg/l)	<1.0	0.75	1.13	1.65	1.08			1.95	0.32

Table B-2: Results of the Construction Area Discharge in February 2019

	Site Name	Spoil Disposal No.2			
	Station Code	DS04			
	Date	07-Feb-19	13-Feb-19	21-Feb-19	28-Feb-19
Parameter (Unit)	Guideline				
pH	6.0 - 9.0	7.79	7.99	7.85	6.72
Sat. DO (%)		86.7	93	78.3	63.5
DO (mg/L)		7.25	7.14	6.43	5.05
Conductivity (µs/cm)		12.15	21	15.21	56.8
TDS (mg/l)		6	10.4	7.6	28.4
Temperature (°C)		23.3	26.6	24	25.7
Turbidity (NTU)		9.05	4.5	4.12	9.20
TSS (mg/L)	<50	8.42	4.14	53.86	
Oil & Grease (mg/L)	<10			<1	

	Site Name	Upstream Spoil Disposal No.2			
	Station Code	DS04-US			
	Date	07-Feb-19	13-Feb-19	21-Feb-19	28-Feb-19
Parameter (Unit)	Guideline				
pH	6.0 - 9.0	6.77		6.98	7.92
Sat. DO (%)		62.6		50.6	73.2
DO (mg/L)		5.15		4.1	5.88
Conductivity (µs/cm)		52.5		57.7	14.28
TDS (mg/l)		26.2		28.85	7
Temperature (°C)		24		25	25.1
Turbidity (NTU)		7.6		10.22	4.72
TSS (mg/L)	<50	3.48		126.68	
Oil & Grease (mg/L)	<10			<1	

ANNEX C: Ambient Dust Quality

Table C- 1: 24-hour Average Dust Concentrations Measured in Hat Gniun Village

Hat Gnuin Village - 24 Hours Average Particulate Matter (PM10) Concentration			
Period	00 to 24 Hours	24 to 48 Hours	48 to 72 Hours
Start Time	04-Feb-19 18:00	05-Feb-19 18:00	06-Feb-19 18:00
End Time	05-Feb-19 18:00	06-Feb-19 18:00	07-Feb-19 18:00
Average Data Record in 24h (mg/m^3)	0.070	0.061	0.070
Guideline Average in 24h (mg/m^3)	***0.12***	***0.12***	***0.12***

Table C- 2: 24-hour Average Dust Concentrations Measured in Phouhomxay Village

Phouhomxay Village - 24 Hours Average Particulate Matter (PM10) Concentration			
Period	00 to 24 Hours	24 to 48 Hours	48 to 72 Hours
Start Time	11-Feb-19 18:00	12-Feb-19 18:00	13-Feb-19 18:00
End Time	12-Feb-19 18:00	13-Feb-19 18:00	14-Feb-19 18:00
Average Data Record in 24h (mg/m^3)	0.093	0.101	0.116
Guideline Average in 24h (mg/m^3)	***0.12***	***0.12***	***0.12***

Table C-3 and Table C-4: Average Results of Noise Monitoring at Song Da5 Camp No. 2 and Lilama10 Camp in February 2019

Song Da5 Camp No.2 - Dust Emission Average in 24 hours	
Period	24 Hours
Start Time	20-Feb-19 18:00
End Time	21-Feb-19 18:00
Average Data Record -24h	0.081
Guideline Average - 24h	***0.12***

Lilama10 Camp - Dust Emission Average in 24 hours	
Period	24 Hours
Start Time	18-Feb-19 18:00
End Time	19-Feb-19 18:00
Average Data Record -24h	0.082
Guideline Average - 24h	***0.12***

Table C-5 and Table C-6: Average Results of Noise Monitoring at Main Dam, and Main Powerhouse in February 2019

Main Dam - Dust Emission Average in 24 hours	
Period	**24 Hours**
Start Time	**21-Feb-19 18:30**
End Time	**22-Feb-19 18:00**
Average Data Record -24h	**0.086**
Guideline Average - 24h	***0.12***

Main Powerhouse - Dust Emission Average in 24 hours	
Period	24 Hours
Start Time	25-Feb-19 18:00
End Time	26-Feb-19 18:00
Average Data Record -24h	0.129
Guideline Average - 24h	***0.12***

ANNEX D: AMBIENT NOISE DATA

Table D- 1: Average Results of Noise Monitoring at Ban Hat Gniun in February 2019

Noise Level (dB)	04-05/February/19			05-06/February/19			06-07/February/19		
	18:30-22:00	22:01 – 06:00	06:01 – 18:00	18:00-22:00	22:01 – 06:00	06:01 – 18:00	18:00-22:00	22:01 – 06:00	06:01 – 18:00
Maximum Value Recorded	61.60	47.00	67.10	62.40	53.40	65.90	56.20	53.80	71.20
Guideline Max	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***
Average Data Recorded	38.60	35.52	38.58	39.07	37.49	40.61	38.16	36.92	38.96
Guideline Averaged	***55***	***45***	***55***	***55***	***45***	***55***	***55***	***45***	***55***

Table D- 2: Average Results of Noise Monitoring at Phouhomxay Village in February 2019

Noise Level (dB)	11-12/February/19			12-13/February/19			13-14/February/19		
	18:00-22:00	22:01 – 06:00	06:01 – 18:00	18:00-22:00	22:01 – 06:00	06:01 – 18:00	18:00-22:00	22:01 – 06:00	06:01 – 18:00
Maximum Value Recorded	59.70	58.70	75.70	67.20	50.20	70.70	56.70	6.00	76.10
Guideline Max	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***
Average Data Recorded	46.36	44.92	43.06	40.44	38.46	39.83	39.54	38.36	38.71
Guideline Averaged	***55***	***45***	***55***	***55***	***45***	***55***	***55***	***45***	***55***

Table D- 3 and Table D- 4: Average Results of Noise Monitoring at Song Da5 Camp No. 2 and Sino Hydro Camp in February 2019

Song Da5 Camp No.2

Noise Level (dB)	20-21/February/19		21/February/19
	18:00 – 22:00	22:01 – 06:00	06:01-18:00
Maximum Value Recorded	48.4	67	67.3
Guideline Max	***115***	***115***	***115***
Average Data Recorded	36.52	41.77	35.82
Guideline Averaged	***70***	***50***	***70***

Lilama10 Camp

Noise Level (dB)	18-19/February/2019		19/February/2019
	18:00 – 22:00	22:01 – 06:00	06:00-18:00
Maximum Value Recorded	59.3	56.1	72.4
Guideline Max	***115***	***115***	***115***
Average Data Recorded	44.85	42.40	40.03
Guideline Averaged	***70***	***50***	***70***

Table D- 5 and Table D- 6: Average Results of Noise Monitoring at Main Dam, and Main Powerhouse in February 2019

Main Dam

Noise Level (dB)	21-22/February/19		22/February/19
	18:30 – 22:00	22:01 – 06:00	06:01-18:00
Data Record Max	60.1	65.2	65.3
Guideline Max	***115***	***115***	***115***
Data Record Average	51.23	53.83	49.43
Guideline Averaged	***70***	***70***	***70***

Main Powerhouse

Noise Level (dB)	25-26/February/19		26/February/19
	18:00 – 22:00	22:01 – 06:00	06:01-18:00
Data Record Max	61.6	65.5	84.3
Guideline Max	***115***	***115***	***115***
Data Record Average	59.90	59.80	62.64
Guideline Averaged	***70***	***70***	***70***