NAM NGIEP 1
POWER COMPANY

Nam Ngiep 1 Hydropower Project

Environmental Management Monthly Monitoring Report

April 2020

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ABBREVIATIONS / 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 April 2020, the Environmental Management Office (EMO) of Nam Ngiep 1 Power Company (NNP1PC) did not receive any document for review and approval due to the suspension of the Project's activities during the COVID-19 lock down imposed by the Prime Minister of Lao PDR no. 06 dated 29 March 2020 until 03 May 2020. Two DWP & SS-ESMMPs submitted by the Contractors in March 2020 will be closed because the constructions were already completed.

Due to the COVID-19 preventative measures imposed by the Thai and Lao Governments since mid-March 2020 until 03 May 2020, the water samples were analysed at the NNP1 Project Environmental Laboratory for TSS, BOD_5, faecal coliform and total coliform and no water samples were shipped to the UAE Lab in Thailand. Also, all surface water and reservoir water quality monitoring stations, community groundwater and community gravity fed water supply monitoring stations were cancelled. Some effluent samples could be undertaken as staff could move around inside the Project area.

The effluent monitoring results for the remaining camps indicate non-compliance with the standards for BOD_5, total coliform and faecal coliform. The effluent from ESD Camp (EF14) fully complied with the standards. On 10 April 2020 NNP1PC signed a contract with an external consultant to assess and evaluate the design and operation of the existing WWTS at the OSOV2 and other sites as well as to provide an improved design using a more permanent technology. It is expected that site visit by the external consultant is to be carried out after the country lock down is lifted. In the meantime, NNP1PC-EMO has provided all relevant designs, drawings and results of the water quality to the consultant for a desk review during the lock down period.

The Dissolved Oxygen (DO) levels at the surface of the Main Reservoir (R1, R2, R3, R4 and R5) were generally between 6 mg/L and 7 mg/L. In the Re-regulation Reservoir (R6 and R7), the DO was generally below 4.2 mg/L this month.

The discharge from the re-regulation dam alternated between discharges from the gate and turbine. Similarly, to March 2020, all DO concentrations (except on 01 and 08 April 2020) were below 6 mg/L at Nam Ngiep downstream stations. However, same as for previous months with similar DO levels, no dead fish was observed during this monitoring period. NNP1PC is in the process of hiring an international consulting company to assist with the design of additional aeration systems to improve the DO level downstream.

A total of 19 m^3 of solid waste was disposed of at the NNP1 Project Landfill, a decrease of 4.4 m^3 compared to March 2020. A total of 2,680 kg of recyclable waste was recorded at the Community Recycle Waste Bank. A total of 23.5 m^3 of solid waste from Phouhomxay, Thahuea and Hat Gniun Villages was disposed of at the Houay Soup Landfill.

An official handover ceremony of the procured office and field equipment under NNP1PC additional No Net Loss (NNL) commitment to support the WRPO of Xaysomboun and Bolikhamxay Provinces in implementing the AIP2019 activities will be organized in May 2020 after the lockdown for COVID-19 is over. Xaysomboun and Bolikhamxay Provincial WRPO confirmed that most of implementation activities under AIP2019 will be postponed.

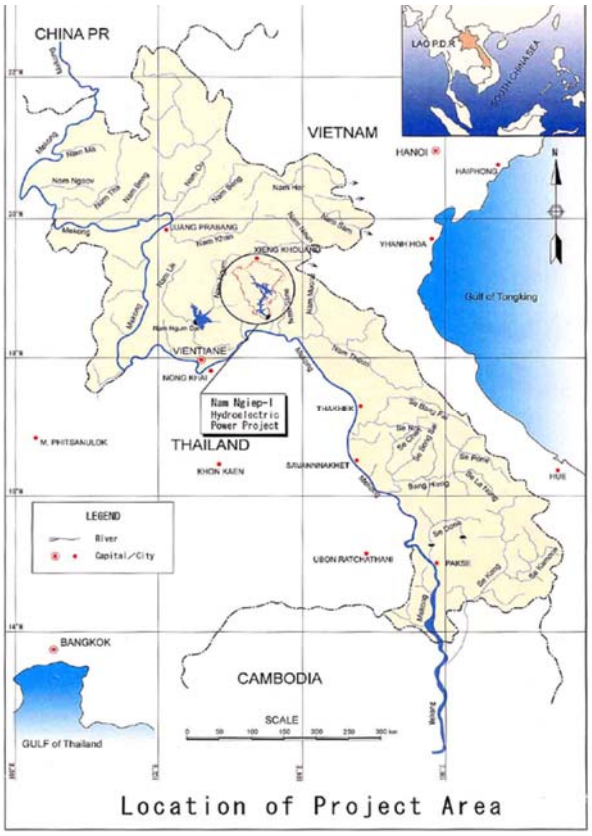
Biodiversity offset related activities under the components of law enforcement and conservation linked livelihood continued in April 2020 with some restrictions as imposed by the GOL (i.e. maintaining social distancing, no gathering and working of more than 10 people, etc.).

The fish catch monitoring for March 2020 in Nam Ngiep watershed was dominated *Channa striata*, *Tor sinensis* and species groups of Poropuntius, Hampala and *Sikukia gudgeri* and *Amblyrhynchichthys truncatus* that are classified as Least Concern (LC) according to the IUCN Red List, except *Tor sinensis* is classified as Vulnerable species and *Sikukia gudgeri* is classified as Data Deficient (DD).

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 have been 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. Each Contract is in its Defects Notification Period all ending variously in 2020 or 2021 following the issue of Taking-over Certificates in 2018 and 2019.

Figure 2-1 shows the progress of the minor outstanding work and defects that comprise the Punch List of work items completed for each of these four principal Contracts for the Project. An addendum to the Punch List is maintained for each Contract for any and all defects list that are discovered during the Defects Notification Period with relevant tabular records made of the date of the discovery, the nature of the defects and by what date the defect was remedied.

FIGURE 2-1: SUMMARY PROGRESS OF MINOR OUTSTANDING WORK AND DEFECTS AT 31 March 2020

Type of Contract Works		Total Items	Items Completed	Completion by No. of Items	Total Value of Items	Value Completed	Completion by Value	Taking-Over
		(No.)	(No,)	(%)	(USD)	(USD)	(%)	(Date)
Civil	RR Power Station	74	74	100	108,890	108,890	100	31-Jan-19
	Main Power Station	482	481	99	5,507,375	5,407,375	98	31-Jan-19
Electro-Mechanical	RRPS	170	170	100	6,515	6,515	100	16-Mar-19
	MPS	95	95	100	10,950	10,950	100	27-Aug-19
Hydro-Mechanical	RRPS	39	39	100	8,825	8,825	100	16-Mar-19
	MPS	174	174	100	13,775	13,775	100	31-Mar-19
230 kV Transmission Line		301	301	100	150,000	150,000	100	31-Jul-18

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 March 2019 was 100 % (compared to planned progress of 100 %) calculated as the value of achieved Interim Milestone Payments excluding advance payment.

The Civil Works overall was always on or ahead of schedule despite increased quantities of dam excavation and slope stabilisation and additional RCC placed in the shear key. During the initial dam excavation and since, it has been written in each Monthly Report, *'the complex bedding of hard over soft layers of rock and the folding nature of these layers in the foundation rock of the main dam below the old river bed had created difficulty to finalise the foundation design to the satisfaction of the Dam Safety Review Panel in all respects'.*

Accordingly, further review of the dam foundation design was carried out to create sufficient safety factor for stability against sliding of the dam on the weak zones. This resulted in further excavation and concreting of a shear key structure in the old river bed, taking the dam height to 167 m, measured from the deepest excavation level to the crest level, some 19 m higher than anticipated. The original schedule is maintained as a result of the combined efforts of the Owner, the Owner's Engineer and all the principal Contractors and their Subcontractors.

The additional excavation works were completed at the end of February 2016 and RCC consolidation grouting and RCC placement for the main dam were commenced on 10 May and 19 April 2016 respectively. The concrete level at the main dam reached El. 321.9 m at the left bank on 29 April 2018 and at the right bank at the end of March 2018. The placed volume of RCC was achieved in close to the planned schedule despite the losses of time resulting from the additional excavation and concreting in the foundation, the loss of fly-ash supply in December 2016, and the fatal accident.

Since the impounding of the Main Dam started on 15 May 2018, monitoring has been carried out to confirm the dam stability, especially to the right abutment where some anomalous results had been noted. Dam monitoring results are shown in a separate 'Monthly Report on Main Dam Instrumentation and Monitoring'. Many of the original concerns have been explained or are better understood. The unforeseen consequences which are considered likely to have been caused by the closing of bedding plane openings, as one of the possible causes considered, began unfolding with events in August 2018 when loading of the dam toe appeared to have caused an inclination of the main powerhouse to upstream and towards the old river bed such that the setting and fixing vertically of both turbine generating units within the required tolerances was not possible. This movement of the powerhouse also affected associated structures such as the penstocks and the intake valve. After the occurrence of this inclination issue, it has been found that artesian aquifer, which was not pressurized before initial impounding, exists under the main powerhouse foundation. Drainage to relieve the pressure is an important means of controlling the artesian aquifer. All current information and opinion are contained in the separate 'Root Cause Assessment of the Main Powerhouse Inclination' which was endorsed by academic authorities. This Report was sent to the insurance company in support of the insurance claim on this issue.

Monitoring of the instruments initially installed continues, more instruments were installed, further drainage drilling was carried out. As related above, all current information and opinion is contained in the separate September Monthly Report on Main Dam Instrumentation and Monitoring. This Report was sent to the Dam Safety Review Panel for review and comment. The reservoir water level of the main reservoir finally reached Full Supply Level of El. 320 m on 17 August 2019 whilst achieving dam safety. At the 19th DSRP Meeting which was held in October 2019, DSRP included in their Report a 'Dam Safety Endorsement' stating that the main dam, re-regulation dam and dyke are safe and fit for purpose, subject to a continued programme of appropriate monitoring, safe project operation and satisfactory resolution of the outstanding issues.

The leakage through drainage pipes from the Bottom Conduit Gate decreased from around 30 m3/min in June 2019 to 1 m3/min in September 2019 thanks to additional grouting using holes drilled from the main dam foundation gallery, a manageable amount, and the permanent concrete plug in this Conduit had been placed since 08 November 2018 after obtaining agreement of the DSRP and completed in 21 January 2019. NNP1PC will study various options to ensure that the reservoir water pressure is safely confined in the long term based on the recommendations of the DSRP.

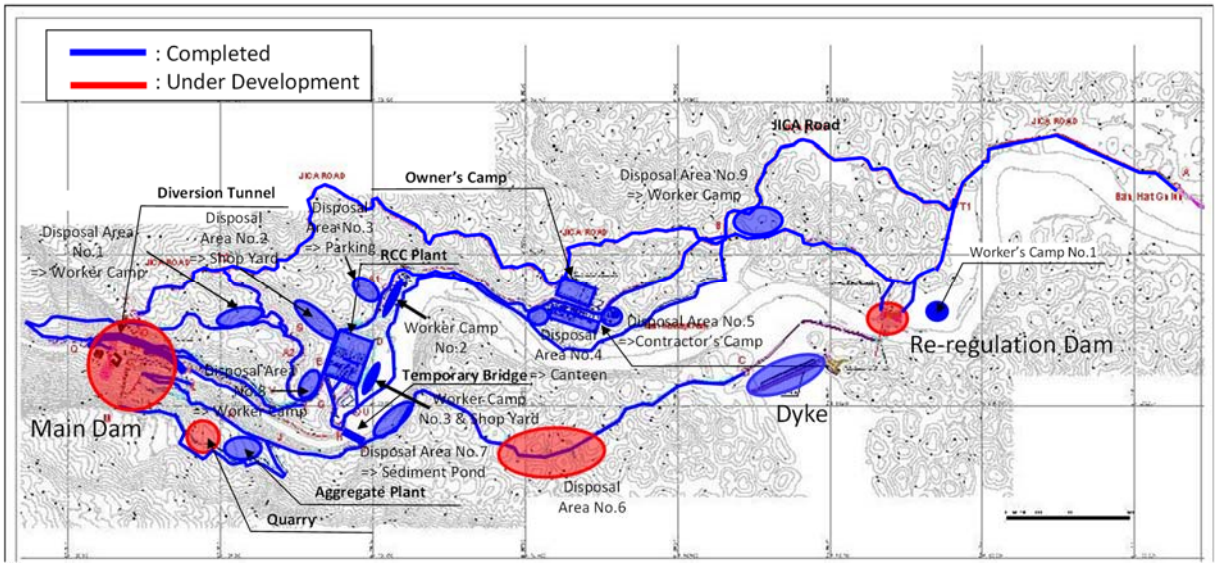
The repairs to the foundation of leg 4 of 230 kV TL Tower No.1 were completed in February 2019. The remaining excavation of the plunge pool was finished in January 2019. The reinforced concrete parapet wall was completed in December 2018 and road deck to the main dam crest and the concrete spillway chutes and piers completed in January 2019.

The issue of a Taking-over Certificate for the Civil Works for both the Re-regulation Power Station and the Main Dam and Main Powerhouse dated 31 January 2019 was made on 19 August 2019 and 22 October 2019, respectively.

2.1.1 ACCESS ROAD CONSTRUCTION

All main access road construction works were completed following an early December 2013 start, and maintenance of these will continue until the anticipated commissioning date in August 2019, six months after when the Civil Contract Time for Completion is reached. Temporary access roads are constructed to reach the various construction activities and others will be developed or modified as is necessary as activities change to reach current or new areas of dam concreting and consolidation grouting, the upstream and downstream cofferdams and the main powerhouse and belt conveyor support tower foundations. The layout of the access road system is as shown in ***Figure 2-2*** below. The Civil Contractor is responsible for decommissioning and rehabilitating the temporary roads as they become redundant.

Figure 2-2: Plan of Site Access Roads with Major Work Area and Temporary Facilities



2.1.2 MAIN DAM AND POWER HOUSE

After starting the main dam excavation in October 2014 on the left bank, these 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 in total than expected and part of this additional work was necessary to construct a 'shear key' structure due to the weak layers of rock encountered in the dam foundation. Following significant efforts on Site, the additional excavation work was completed at the end of February 2016. The cost of the additional excavation and RCC concrete placement necessitated expenditure of contingency amounts provided exactly for such eventualities. The dental concreting works were commenced in March 2016, and conventional levelling concrete placement for the main dam in the 'shear key' structure up to El. 170.5 m was completed in the middle of April 2016. Consolidation grouting at the main dam area was commenced on 10 May 2016 and RCC concrete placement for the main dam body was commenced on 19 April 2016. Consolidation grouting covers the whole footprint of the main dam and RCC concrete placement and

consolidation grouting are implemented in parallel, section by section. The progress of RCC concrete placement is 100 % complete. The dam height has reached crest level at El. 321.9 m at both left bank and right bank. The plunge pool excavation was started after main dam impounding and this work has been suspended because of spilling water from spillway gate during rainy season in 2018. It has resumed from the end of October when the amount of inflow has decreased to around 100 m3/s and around 121,000 m3 or 100 % of total excavation has now been completed.

The diversion conduit gate of the main dam body has some leakage of water initially and the casting of the temporary concrete plug behind it was completed in the conduit in June 2018. The permanent concrete plug had been placed since 08 November 2018 after DSRP permission was granted.

Main powerhouse sub-structure excavation works were completed in January 2016 and levelling concrete works were started in coordination with installation of the grounding system and the penstock concrete encasement. Major concrete of the main powerhouse was substantially completed in December 2017. The powerhouse concreting works has been completed in January 2019.

2.1.3 RE-REGULATION DAM, POWERHOUSE AND DYKE

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 overall re-regulating dam and powerhouse works at the left bank section and the right bank and labyrinth weir are shown in ***Figure*** below. After the completion of the re-regulation dam above, impounding of the reservoir has been carried out having been commenced on 15 May and been completed on 24 May 2017. After Main Dam impounding started, the reservoir storage of the re-regulation dam has been used for the riparian discharge to downstream in accordance with the Concession Agreement.

FIGURE 2-3: COMPLETED RE-REGULATION DAM AND POWERHOUSE AT THE END OF JUNE 2018

2.1.4 TEMPORARY WORK FACILITY

2.1.4.1 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.

2.1.4.2 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 for this cofferdam were completed on 02 April 2016.

2.1.4.3 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 all plants and is almost completed for the Quarry and the Aggregate Crushing Plant.

Demobilization of plant facilities for both RCC and CVC plants was completed in December 2019. The vegetation improvement for rehabilitation of those areas is ongoing

Figure 2-4 : Re-vegetation of RCC Plant Yard

Figure 2-5: Re-vegetation of CVC Plant Yard

2.1.4.4 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 was acceptable though unsuitable soil layers were removed to spoil disposal areas, and good quarry management prevailed. It was considered that the quarry as originally conceived would not yield enough rock material of the required specification to complete all RCC and CVC concrete works for the Project. Permission was taken to extend the existing quarry within the boundaries already approved after a preliminary soil investigation confirmed that appropriate material could be exploited as below. The planned extension area of the quarry received approval from local government. (See ***Figure 2-4*** below)

The surface clearing, topsoil and overburden removal works at the extension area were completed in December 2016 and its development works was commenced in January 2017. The final blasting was carried out 27 March 2018. GOL have acknowledged that the quarry operation is complete. After several inspections by GOL and ADB for the Lenders, the quarry site has been improved by such as partial levelling, vegetation at the berms of slopes and large rock installation at top of slopes from an environmental and a safety point of view. Furthermore, a fence around the pond, which is created at the quarry only during the rainy season and is dry during dry season, will be installed to prevent people and animals from entering the pond, subject to ADB approval. A gate near the steel bridge also a barrier to public access. Permanent fence installation around pond as shown in the below picture will not be installed and fence for road safety will be installed at the top of the right bank upper quarry roadside. The levelling of quarry bottom will be implemented from January 2020.

Figure 2-6: Quarry Area View Showing Re-Vegetation and Safety Fence Installation

2.1.4.5 DISPOSAL AREAS

The disposal areas are on the right bank has been available for operation since January 2015, as was the adjacent waste Disposal Area No.9. Disposal Area No.9 along Road P1 near the start of Road T5 started operation in April 2015. Unsuitable material from the quarry has ceased to be hauled to Disposal Area No.6 and Disposal Area No.9 has been developed by 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 Notice to Proceed was issued in 03 October 2014. The cumulative work progress of the Electrical and Mechanical Works by value at the end of November 2019.

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 March 2019 was 100 % (compared to planned progress of 100 %). NNP1PC issued the Taking Over Certification for the main powerhouse and the re-regulation powerhouse, which was dated on 31 March 2019 for the main powerhouse and 16 March 2019 for the re-regulation powerhouse, to IIS on 30 September 2019 and 16 August 2019, respectively.

2.4 230 kV Transmission Line Works

The 230 kV Transmission Line Contract was executed between Loxley-Sri Consortium and NNP1PC on 11 July 2014 and the NTP was issued to the 230 kV TL Works Contractor on 03 October 2014. The cumulative actual work progress of the Transmission Line Works at the end of July 2018 was 100 %, the same as planned progress. NNP1PC issued the Taking Over Certification, which was dated on 31 July 2018, to Loxley on 6 November 2018. The Defects Notification Period for this Contract expired on 31 July 2019.

3. ENVIRONMENTAL MANAGEMENT MONITORING

3.1 Compliance Management

In April 2020, the Environmental Management Office (EMO) of Nam Ngiep 1 Power Company (NNP1PC) did not receive any document for review and approval due to the suspension of the Project's activities during the COVID-19 lock down imposed by the Prime Minister of Lao PDR no. 06 dated 29 March 2020 until 03 May 2020. Two DWP & SS-ESMMPs submitted by the Contractors in March 2020 will be closed because the constructions were already completed.

Table 3-1: SS-ESMMP and documents Review Status in April 2020

Title	Date Received	Status
DWP & SS-ESMMP for the Installation of Double Corrosion Protection Rock Bolts at the Left Bank Slope	07 February 2020 (2nd submission)	Closed (Construction was completed)
DWP & SS-ESMMP for Supply and Installation of Log Booms at the Main Dam and Re-regulation Dam of Namgiep1 Hydropower Project	12 February 2020 (2nd submission)	Closed (Construction was completed)

The status of compliance reports (Observation of Non-Compliance or ONC, Non-Compliance Report or NCR) issued by NNP1PC to the Contractors is summarized in below

TABLE 3-2: SUMMARY OF ONCS AND NCRS

Items	ONC	NCR-1	NCR-2	NCR-3
Carried over from March 2020	6	0	0	0
Newly Opened in April 2020	0	1	0	0
Total in April 2020	**8**	**0**	**0**	**0**
Resolved in April 2020	0	0	0	0
Carried over to May 2020	6	0	0	0
Unsolved Exceeding Deadlines	**6**	**1**	**0**	**0**

3.1.1 INSPECTION BY ENVIRONMENT MANAGEMENT UNIT

The proposed joint site visits by the MONRE; Bolikhamxay Provincial Office of Environmental and Natural Resources (PONRE), Bolikhan District EMU (Bolikhamxay Province) and; Xaysomboun PONRE and Thathom Districts was postponed until the country lockdown to prevent the COVID-19 outbreak is lifted by the Government.

3.2 ENVIRONMENTAL QUALITY MONITORING

The analyses of Total Suspended Solids (TSS), Biochemical Oxygen Demand (BOD), faecal coliforms, E.Coli bacteria and total coliforms have been carried out by NNP1PC's environmental laboratory since August 2017.

All data are reported to the Ministry of Natural Resources and Environment (MONRE) monthly and quarterly to the ADB. The reports are also published on the Company's website at https://namngiep1.com/resources/monitoring-reports/

Due to the COVID-19 preventative measures imposed by the Thai and Lao Governments since mid-March 2020 until 03 May 2020, the water samples were analysed at the NNP1 Project Environmental Laboratory for TSS, BOD_5, faecal coliform and total coliform and no water samples were shipped to the UAE Lab in Thailand. Also, all surface water and reservoir water quality monitoring stations, community groundwater and community gravity fed water supply monitoring stations were cancelled. Some effluent samples could be undertaken as staff could move around inside the Project area

3.2.1 EFFLUENT DISCHARGE FROM CAMPS AND CONSTRUCTION SITES

Detailed monitoring results are provided in the ***Annex B*** of this Report. The effluent monitoring results for the camps in April 2020 indicate non-compliances for BOD_5, total

coliform and faecal coliform. The effluent from OSOV2 (ESD Camp – EF14) fully complied with the standards.

Due to the lockdown during April 2020, the analyses for TSS, BOD_5, faecal coliform and total coliform were performed by the NNP1PC Environmental Laboratory, and no effluent samples were shipped to UAE Laboratory, Thailand. Therefore, there are no results for COD, ammonia-nitrogen, total nitrogen, total phosphorus and oil and grease in this reporting period.

The status of the implementation of the corrective actions addressing non-compliances at the camps and key project facilities that continue to have non-compliances is summarized in summarized in below.

TABLE 3-3: STATUS OF CORRECTIVE ACTIONS FOR NON-COMPLIANCES AT CAMPS AND CONSTRUCTION SITES

Site	Sampling ID	Status	Corrective Actions
OSOV1	EF01	Non-compliance for total coliform.	A contract with an external consultant was signed on 09 April 2020. It is expected that the external consultant will visit the site after the country lock down is over to evaluate the design and operation of the existing remaining WWTS and to provide an improved design using a more permanent technology. So far, EMO provided the design drawing and water quality results to the Consultant for doing a desk review.
OSOV2 (ESD Camp)	EF13	Non-compliance for BOD_5, faecal coliform and total coliform.	As above.
	EF14	The parameters monitored were complied with the standard.	
Main Powerhouse	EF19	No effluent was discharged during the mission schedule.	EMO is coordinating with the responsible staff for collecting sample of the discharged effluent for analysis by EMO in May 2020.

3.2.2 AMBIENT SURFACE WATER QUALITY MONITORING

In addition, weekly depth profile monitoring (pH, DO, conductivity, TDS and temperature) has been undertaken since 18 September 2018 for stations located in the re-regulation and main

reservoirs. The water quality programme is summarized in Table 3-4 and the location of the monitoring stations are shown in below.

The ambient surface water quality monitoring programme comprises five monitoring stations in the main reservoir (R1-R5), two stations in the re-regulation reservoir (R6 and R7), five stations in the mainstream Nam Ngiep (NNG01 and NNG05 to NNG08) and four stations in the main tributaries to Nam Ngiep (Nam Chiane [NCH01], Nam Phouane [NPH01], Nam Xao [NXA01] and Nam Houay Soup [NHS01]).

In addition, weekly depth profile monitoring (pH, DO, conductivity, TDS and temperature) has been undertaken since 18 September 2018 for stations located in the re-regulation and main reservoirs. The location of the monitoring stations is shown in Figure 3-1.

Due to the country and site lockdown, only pH, DO, Conductivity, Temperature, Turbidity, TSS, BOD_5, Faecal Coliform and Total Coliform were measured and analysed in April 2020.

The monitoring results for key parameters (DO, TSS and BOD_5) during April 2020 are presented in ***Table 3-5, 3-6*** *and* ***3-7***. The full set of data for April 2020 is attached in ***Annex A***. In addition, the results for DO are presented as line graphs in ***Figure 3-2.***

Main Reservoir

During April 2020, the water level in the main reservoir decreased from El. 303.9 m asl to El. 301.5 m asl.

Due to the country and site lockdown, the depth profile water quality monitoring at R1, R2, R3, R4, R6 and R7 were implemented only one time as the team could not use a local boat driver for the main reservoir and re-regulation reservoir sampling during the camp lockdown.

At R5, during April 2020, the DO level in the upper 7.5 m was generally between 5 mg/L and 9 mg/L, and an oxycline had formed at a depth between 8.0 m and 11.0 m corresponding to El. 290 m asl – 294 m asl. The entire water column below 11.0 m had a DO level of less than 1 mg/L.

At R4, the DO concentrations in the upper 7.0 m was generally about 6 mg/L, and in the entire water column below 9.0 m, the DO concentration was less than 1 mg/L.

The DO concentrations at R3 were recorded between 5 mg/L and 7 mg/L in the upper 6.5 m. The concentration of DO in the water column between 9.0 m and 22.0 m were generally less than 1 mg/L. The DO concentration in the water column below 24.0 m fluctuated between 0.07 mg/L and 3.50 mg/L.

At R2, the DO concentrations in the upper 3.5 m was generally between 6 mg/L and 7 mg/L, and in the entire water column below 14.0 m, the DO concentration was less than 1 mg/L.

At R1, the DO level was generally about 6 mg/L in the entire water column.

The measurements indicate the formation of oxyclines in R2, R3, R4 and R5.

As expected, the TSS concentrations in the main reservoir have been consistently low since the start of impounding with a mean 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 measurement at R5 in both epilimnion and hypolimnion were within the standard.

Re-regulation Reservoir

In April 2020, the turbine discharge from the main dam varied between 140 m^3/s and 220 m^3/s interrupted by usually night-time periods with no discharge.

The DO measurements at R6 and R7 representing turbine discharges from the main dam generally had DO concentrations from about 0.11 mg/L to about 4 mg/L in the entire water column.

The BOD_5 concentration in R6 and R7 were between 5.9 mg/L and 3.7 mg/L respectively.

Downstream

During April 2020, the discharge from the re-regulation dam alternated between discharges from the gate and turbine. All DO concentrations were less than 6 mg/L at the Nam Ngiep Downstream stations (except on 01 and 08 April 2020 due to aeration from gate discharge) and thus are non-compliant with the National Standard. No dead fish were observed in Nam Ngiep downstream during the periods with low DO. NNP1PC is in the process of hiring an international consulting company to assist with the design of additional aeration system to improve the DO level downstream.

The BOD_5 in the downstream stations were between 1.53 mg/L and 2.25 mg/L.

FIGURE 3-1: SURFACE WATER AND RE-REGULATION RESERVOIR WATER QUALITY MONITORING STATIONS

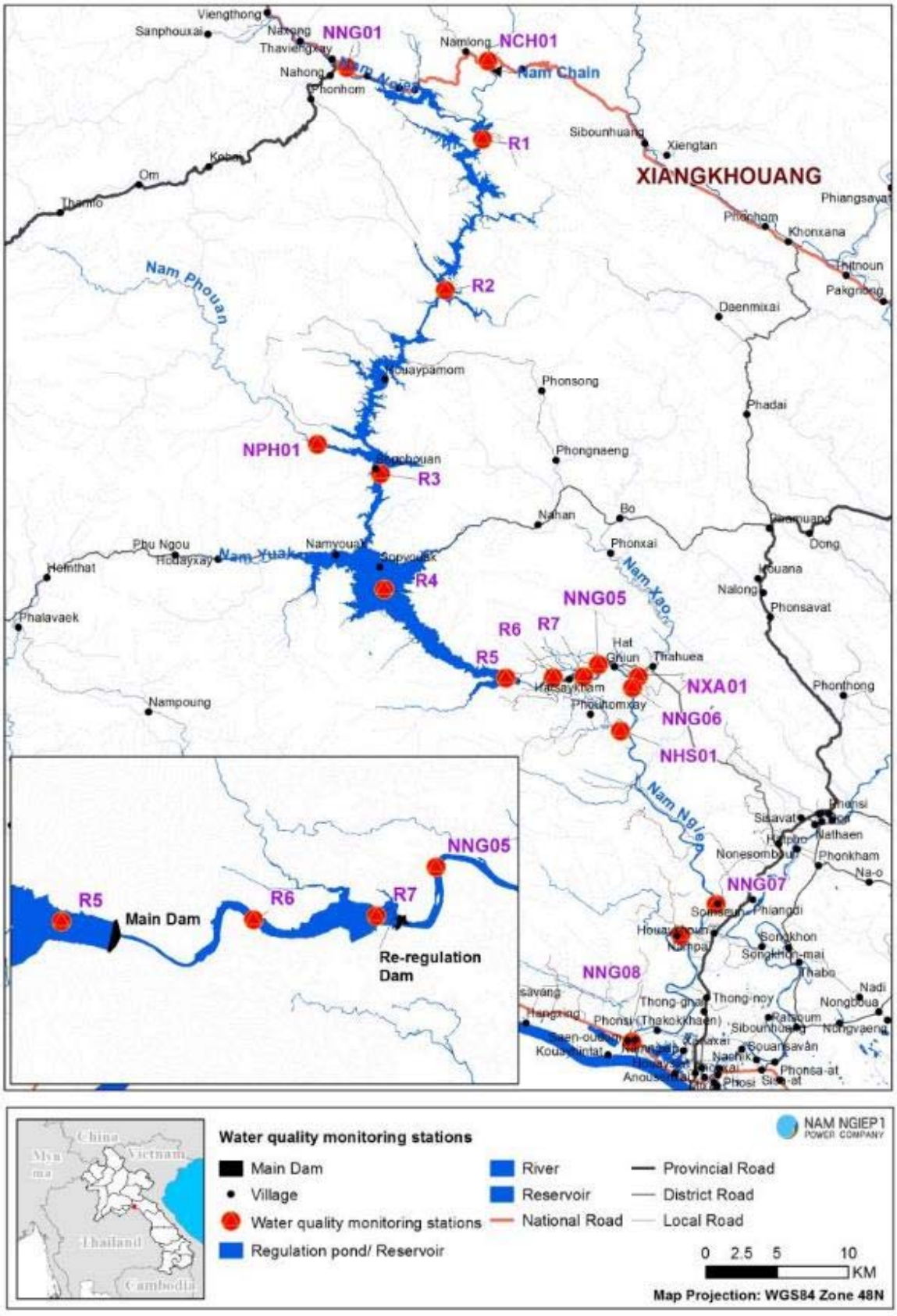


FIGURE 3-2: CONCENTRATION OF DISSOLVED OXYGEN IN THE UPPER 0.2 M SINCE SEPTEMBER 2019 TO APRIL 2020

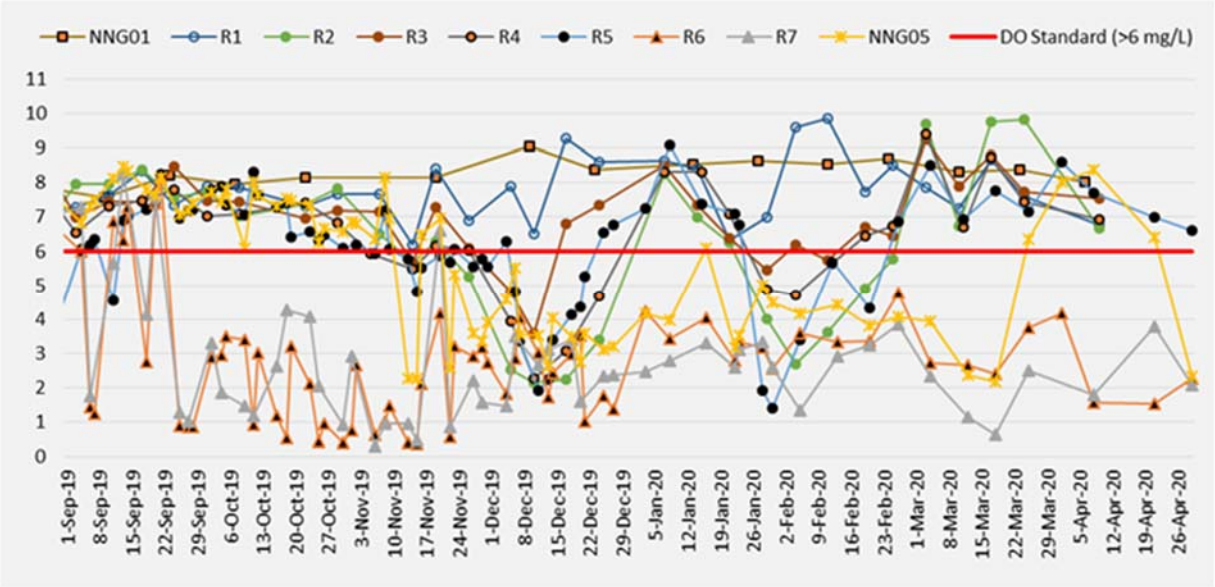


TABLE 3-4: ***RESULTS OF SURFACE WATER QUALITY MONITORING FOR DISSOLVED OXYGEN (MG/L) IN THE UPPER 0.2 M, WATER QUALITY STANDARD: >6.0 MG/L***

DO (mg/L)	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
1-Apr-20						8.6	4.17		8.02		7.5	7.8				
6-Apr-20	8.03												7.51			
8-Apr-20						7.71	1.56	1.8	8.38	8.07	6.17	6.09			6.89	8.23
9-Apr-20		6.8	6.68	7.53	6.94									7.96		
21-Apr-20						6.98	1.53	3.79	6.43		5.84	4.25			6.17	
29-Apr-20						6.62	2.27	2.07	2.34		4.75	5.59			5.82	

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
21-Apr-20						<5	<5	5.2	<5		15.2	26.5			7.8	
21-Apr-20 Hypolimnion						<5										

TABLE 3-6: ***RESULTS OF SURFACE WATER QUALITY MONITORING FOR BOD_5 (MG/L) - WATER QUALITY STANDARD: < 1.5 MG/L***

BOD_5 (mg/L)	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
21-Mar-20						<1	5.93	3.76	1.53		2.25	1.52			<1	
21-Apr-20 Hypolimnion						<1										

3.2.3 GROUNDWATER QUALITY MONITORING

During April 2020, the monthly community groundwater monitoring was not carried out due to the site lockdown.

3.2.4 GRAVITY FED WATER SUPPLY (GFWS) QUALITY MONITORING

During April 2020, the monthly GFWS water quality monitoring at Hat Gniun Village and Phouhomxay Village was not carried out due to the site lockdown.

3.2.5 LANDFILL LEACHATE MONITORING

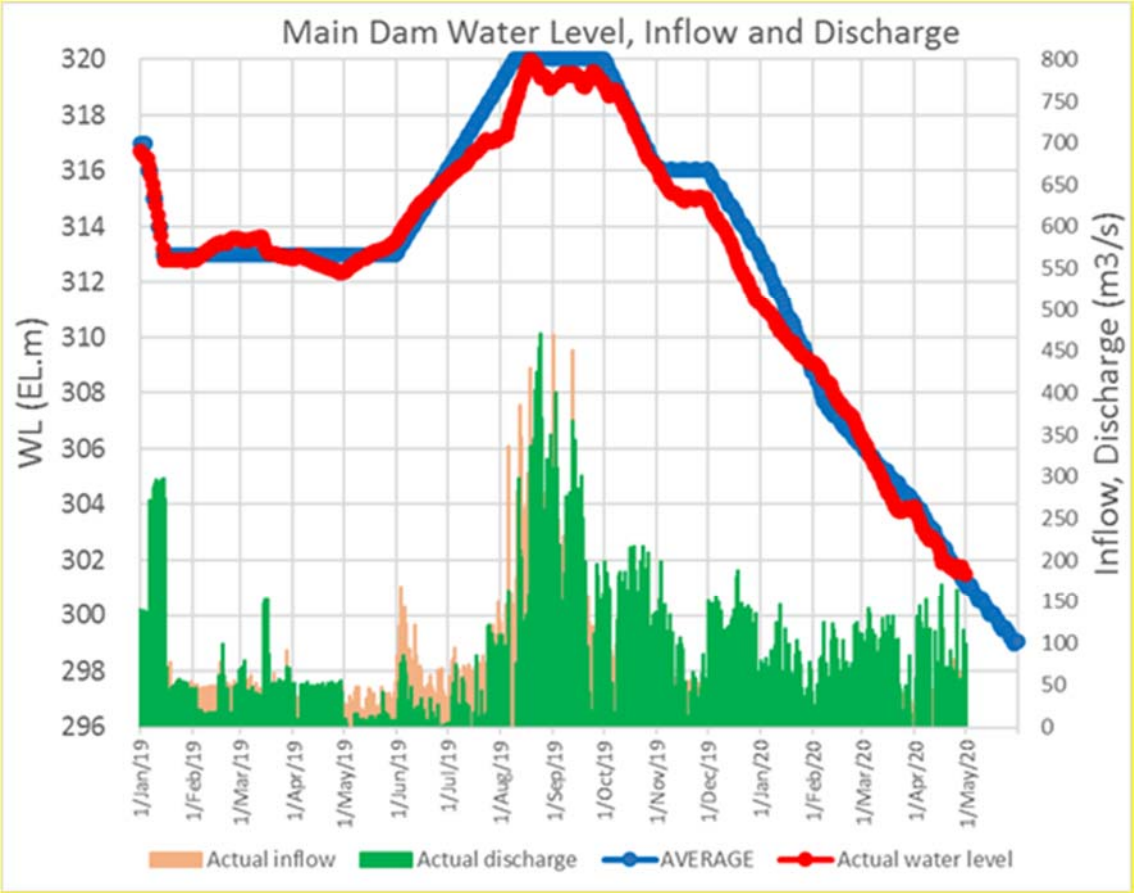
During April 2020, water sampling from NNP1 Project Landfill and Houay Soup Solid Waste Landfill were not carried out because there was no inflow of leachate into the ponds and the last pond in both landfills had almost dried-up.

3.2.6 DISCHARGE MONITORING

The water level in the main reservoir, inflow to the reservoir and discharge from the reservoir since the start of the impounding on 15 May 2018 is presented in the graph in Figure 3-3.

During April 2020, the mean inflow to the main reservoir was 50 m^3/s (min 27 m^3/s and max 114 m^3/s). During April 2020, the water level in the main reservoir decreased with 2.4 m from El. 303.9 m asl. to El. 301.5 m asl.

FIGURE 3-3: WATER LEVEL, INFLOW AND DISCHARGE FOR THE MAIN RESERVOIR

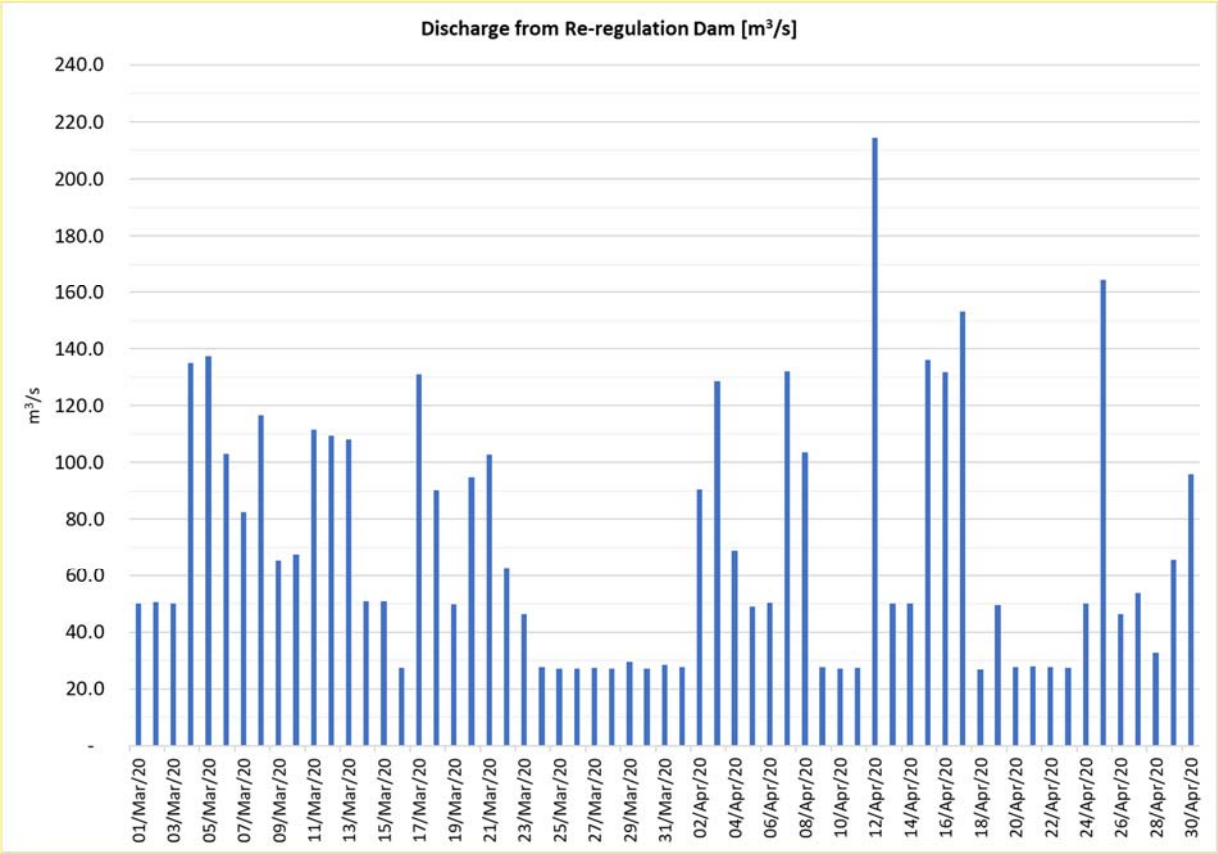


The discharge monitoring data for the re-regulation dam during March 2020 and April 2020 is presented in Figure 3-4.

During April 2020, the mean discharge from the re-regulation dam was about 80 m^3/s with turbine discharges varying between 50 m^3/s and 160 m^3/s interrupted by periods with gate discharge of about 28 m^3/s.. The discharge was kept above the minimum flow requirement of 27 m^3/s at all times.

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 IN MARCH 2020 AND APRIL 2020



3.2.7 NAM NGIEP DOWNSTREAM WATER DEPTH MONITORING

In April 2020, EMO carried out only one boat mission to monitor the water depth in the Nam Ngiep downstream of the re-regulation dam. A total of 19 sites have been identified with potential shallow water depths. None of these sites were difficult to navigate.

3.3 PROJECT WASTE MANAGEMENT

3.3.1 SOLID WASTE MANAGEMENT

In April 2020, a total of 19 m^3 solid waste was disposed of at the NNP1 Project Landfill, a decrease of 4.4 m^3 compared to March 2020. On 01 April 2020, EMO conducted a waste management awareness induction for NNP1PC's housekeepers and drivers in the OSOV1 and OSOV2 (ESD camp).

A total of 150 wooden poles were jointly purchased from local people by NNP1PC and the local waste collection Contractor for the replacement of the existing wooden poles at NNP1 Project Landfill that had rotted. The installation is expected to be carried out from middle of May 2020.

TABLE 3-7: AMOUNTS OF RECYCLABLE WASTE SOLD

Source and Type of Recycled Waste		Unit	Sold	Cumulative Total by April 2020
Camp Operations				
1	Glass bottles	kg	0	38
2	Plastic bottles	kg	0	41
3	Paper/Cardboard	kg	0	17
4	Aluminium cans	kg	0	39
Sub-Total 2		**kg**	**0**	**135**
Grand Total 1+2		**kg**	**0**	**135**

The local villagers from Phouhomxay Village collected a total of 910 kg of food waste from the OSOV1 canteen for animal feed in April 2020, an increase of 436 kg compared to March 2020 because most staff stayed on site during the COVID-19 outbreak prevention period.

TABLE 3-8: AMOUNTS OF FOOD WASTE COLLECTED BY VILLAGERS

No.	Site Name	Unit	Total
1	OSOV1 Canteen	kg	910
Total		**kg**	**910**

3.3.2 HAZARDOUS MATERIALS AND WASTE MANAGEMENT

The types and amounts of hazardous material and hazardous waste stored on site in April 2020 are shown in Table 3-9 and Table 3-10.

TABLE 3-9: RESULTS OF HAZARDOUS MATERIAL INVENTORY

No.	Hazardous Waste Type	Unit	Total in April 2020 (A)	Used (B)	Remainder (A - B)
1	Diesel	Litre	11439	21135	9304
2	Gear Lubricant	Litre	646	0	646
3	Liquid Chlorine	Litre	58	20	38
4	Grease	Drum (25 L)	29	0	29
5	Chlorine Powder	Kg	23	1	23
6	Sika	Can	7	0	7
7	Colour paint	Drum (20L)	3	0	3
8	Thinner	Drum (3 L)	1	0	1

TABLE 3-10: RESULTS OF HAZARDOUS WASTE INVENTORY

No.	Hazardous Waste Type	Unit	Total in April 2020 (A)	Dispose (B)	Remainder (A - B)
1	Used oil	Litre	2,072	2,000	72
2	Ink cartridge	Unit	119	0	119
3	Halogen/fluorescent bulbs	Unit	78	0	78
4	Empty spray can	Can	80	0	80
5	Contaminated soil/sand	Cubic Metre (m^3)	0.17	0	0.17
6	Clinic waste	kg	4.4	0	4.4

3.4 COMMUNITY WASTE MANAGEMENT

3.4.1 COMMUNITY RECYCLING PROGRAMME

In April 2020, the Community Recycle Waste Bank received no recyclables from Phouhomxay Village and the two host villages due to the village lockdown for COVID-19 prevention. The cumulative total amount of recyclable waste stored is 2,680 kg, the same amount as in March 2020.

TABLE 3-11: TYPES AND AMOUNTS OF RECYCLABLE WASTE TRADED AT THE COMMUNITY RECYCLE WASTE BANK

Types of Waste	Unit	Remaining in March 2020	Additional in April 2020	Sold/dis pose	Remaining in April 2020
Glass bottles	kg	1,792	0	0	1,792
Paper/cardboard	kg	852.5	0	0	852.5
Plastic bottles	kg	35.5	0	0	35.5
Aluminium cans	kg	0	0	0	0
Scrap metal	kg	0	0	0	0
Total	**kg**	**2,680**	**0**	**0**	**2,680**

3.4.2 COMMUNITY SOLID WASTE MANAGEMENT

Approximately 23.5 m^3 of solid waste was collected from the host and Phouhomxay Villages for disposal at Houay Soup landfill, a decrease of 7 m^3 compared to March 2020.

3.5 WATERSHED AND BIODIVERSITY MANAGEMENT

3.5.1 WATERSHED MANAGEMENT

3.5.1.1 IMPLEMENTATION OF ANNUAL IMPLEMENTATION PLAN (AIP) 2019

The boat supplier finalized a design of the boat hull including the external painting on the side of the boat based on the request of GOL. An official handover ceremony of the procured office and field equipment under NNP1PC additional No Net Loss (NNL) commitment to support the

WRPO of Xaysomboun and Bolikhamxay Provinces in implementing the AIP2019 activities will be organized in May 2020 after the lockdown for COVID-19 is over.

Xaysomboun and Bolikhamxay Provincial WRPO confirmed that most of implementation activities under AIP2019 will be postponed until the lockdown for COVID-19 outbreak is over. Xaysomboun Provincial WRPO is preparing the progress report of the AIP2019 implementation and the status report of AIP2020 preparation based on the request from NNP1PC.

NNP1PC-EMO together with a Consultant finalized a draft Fishery Co-Management Plan (FMCP) and regulations for reservoir fishery management on 27 April 2020. The document was circulated to relevant GOL offices in Xaysomboun and Bolikhamxay on 28 April 2020 for their review.

NNP1PC-EMO together with a Consultant is preparing an assessment report of options for sustainable livelihood opportunities of NNP1 watershed villages. The first draft report was submitted by the Consultant on 03 April 2020. This report was reviewed and discussed at the end of April 2020. The revised report is expected to be submitted in May 2020.

3.5.2 BIODIVERSITY OFFSET MANAGEMENT

3.5.2.1 ENGAGEMENT OF BIODIVERSITY SERVICE PROVIDER (BSP)

ADB and WCS (Wildlife Conservation Society as a Biodiversity Service Provider) provided their comments on a second revised draft of Memorandum of Understanding (MOU) on 20 April 2020. NNP1PC is working with its lawyer to review and address their comments. The final draft is expected to be ready in May 2020.

Xaysomboun and Bolikhamxay Provincial Agriculture and Forestry Offices (PAFO) received an official letter from the Department of Forestry (DOF) of Ministry of Agriculture and Forestry (MAF) on 24 April 2020 to notify on the WCS engagement as a Biodiversity Service Provider (BSP) under an ADB Project through MAF and request PAFOs to facilitate the attainment of necessary permits from relevant authorities for the WCS staff to work with NNP1PC staff and get access to the relevant sites.

NNP1PC-EMO and the BSP team planned to have a kick off workshop with Bolikhamxay Provincial BOMU in May 2020 after the lockdown for COVID-19 is over. NNP1PC-EMO and the BSP team have engaged in several discussions at NNP1PC-ESD office on site on the preparation of Law Enforcement Strategy document for NC-NX offset site, the future biological monitoring focussing on the design of camera trap and listening post survey for the NC-NX offset site and NNP1 sub-catchment, community outreach program, conservation linked livelihood and the training for patrolling and SMART.

3.5.2.2 IMPLEMENTATION OF BOMP ANNUAL IMPLEMENTATION PLAN (AIP) 2019 AND 2020

Bolikhamxay Provincial Biodiversity Offset Management Unit (BOMU) has continued implementing the planned activities using the remaining budget of AIP2019. After receiving the ADB no-objection for the AIP2020 prepared by GOL and NNP1PC on 03 March 2020, the BOMU officially submitted the AIP2020 approved by ADB to the Bolikhamxay Provincial Biodiversity Offset Management Committee or BOMC for review and approval. The BOMC approved the AIP2020 on 30 March 2020. An official request for fund disbursement for the

first and second quarters of 2020 under the approved AIP2020 was only issued by DOF-MAF on 24 April 2020 due to the lockdown for COVID-19 prevention. NNP1PC is preparing documents for internal management approval before disbursing to DOF-MAF.

Progresses on the implementation of key activities by Component in April 2020 are described below:

a. Component 1 - Spatial Planning and Regulation

The signage installation in the remaining villages have to be postponed until the Government lifts the COVID-19 preventive measures.

b. Component 2 – Law Enforcement

In line with the GOL preventive measures for COVID-19 outbreak, the four patrol teams continued the patrolling between 08 to 28 April 2020 with the focus along the road access and some potentially high threat areas such as Nam Ma, Nam San, Nam Chouan and Nam Tan. The result of April 2020 patrolling will be presented and discussed in May 2020.

The data presented here is the results of patrolling activity in March 2020.

In March 2020, the first team carried out patrolling at the TPZ highest priority area including Nam Sone, Nam Chang and Nam Chouane. They spent 15 days covering a distance of 74 km on forest patrolling and 12 km on road patrolling. The team made a total of nine direct observations and eight indirect observations of the following wildlife: macaques, black giant squirrel, muntjac, otters, phayre's leaf monkeys, red-shanked douc langur, sambar, white-cheeked gibbons, wild pigs, Indochinese serow and red turtle-dove. The team did not encounter any threats during the patrolling.

In March 2020, the second team carried out patrolling at Nam Ma TPZ high priority area including Nam Ma, Nam Chouane, Nam Kapong and Nam Sa Nga. They spent 16 days covering a distance of 63 km on forest patrolling and 23 km on road patrolling. The team made a total of six direct observations and five indirect observations of the following wildlife: brown hornbills, great hornbills, macaques, muntjac, white-cheeked gibbons, wild pigs, and Indochinese serow. The team encountered a number of threats such as land clearing for upland cultivation and NTFP collection (Haem).

In March 2020, the third team carried out patrolling at Xaychamphone District side including Nam Houng, Nam Tan, Nam Lak, Nam Chamhung and Houykhone. They spent 16 days covering a distance of 63 km on forest patrolling and 13 km on road patrolling. The team made a total of eight direct observations and five indirect observations of the following wildlife: black giant squirrels, brown hornbills, hog badger, macaques, muntjac, otters, white-cheeked gibbons, and sambar. The team also encountered a number of threats such as hunting camp with 150 small wire snares and fishing camps along Nam Houng area and its tributaries. This camp was destroyed by the patrol team.

In March 2020, the fourth team carried out patrolling at Nam Houng TPZ high priority area. They spent 16 days covering a distance of 77 km on forest patrolling. The team made a total of four direct observations and seven indirect observations of the following wildlife: black giant squirrels, macaques, red-shanked douc langurs, white-cheeked gibbons, civet, muntjac, Indochinese serow, otter, sambar, and wild pigs. The team also encountered small hunting camps and fishing camps with the dry rack. These camps were destroyed by the patrol team.

FIGURE 3-5: MAP OF THREATS RECORDED BY PATROLLING TEAMS IN MARCH 2020

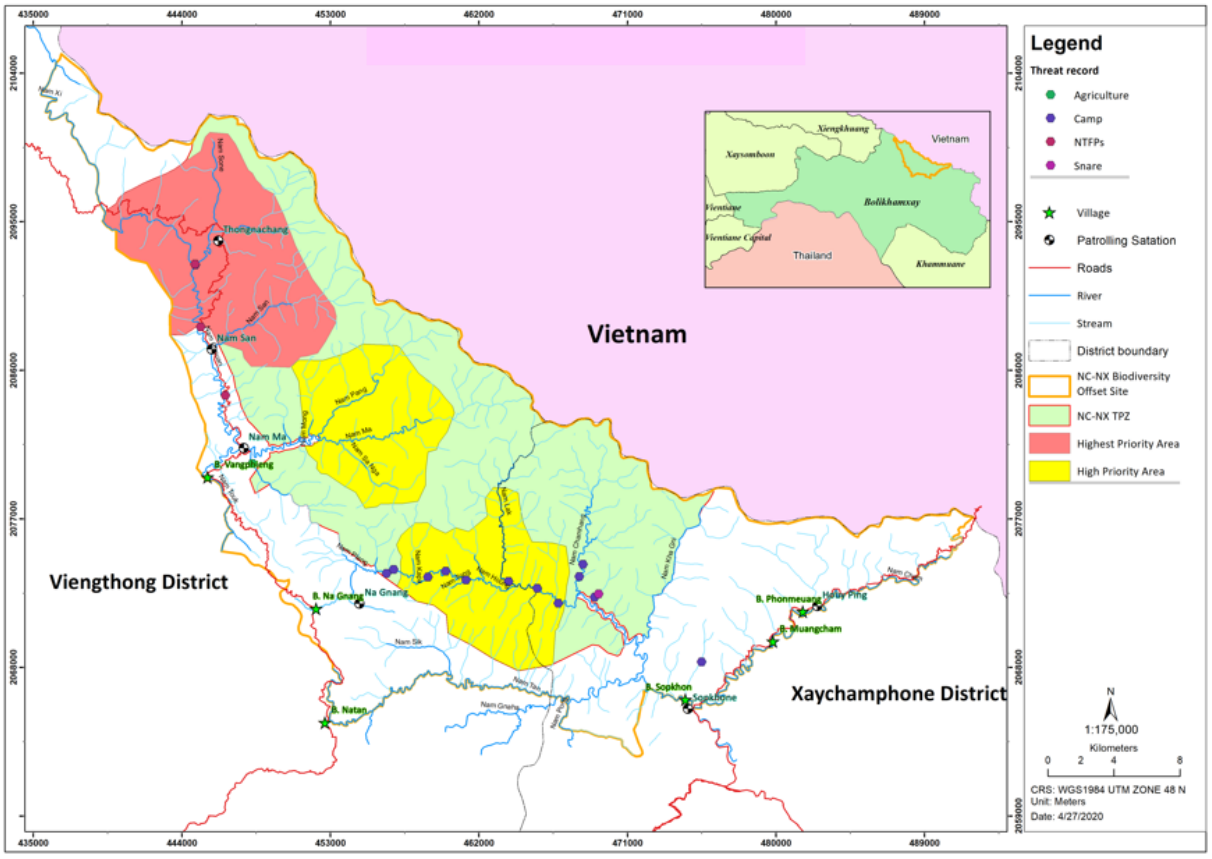


FIGURE 3-6: MAP OF WILDLIFE SIGNS RECORDED BY TWO PATROLLING TEAMS IN MARCH 2020

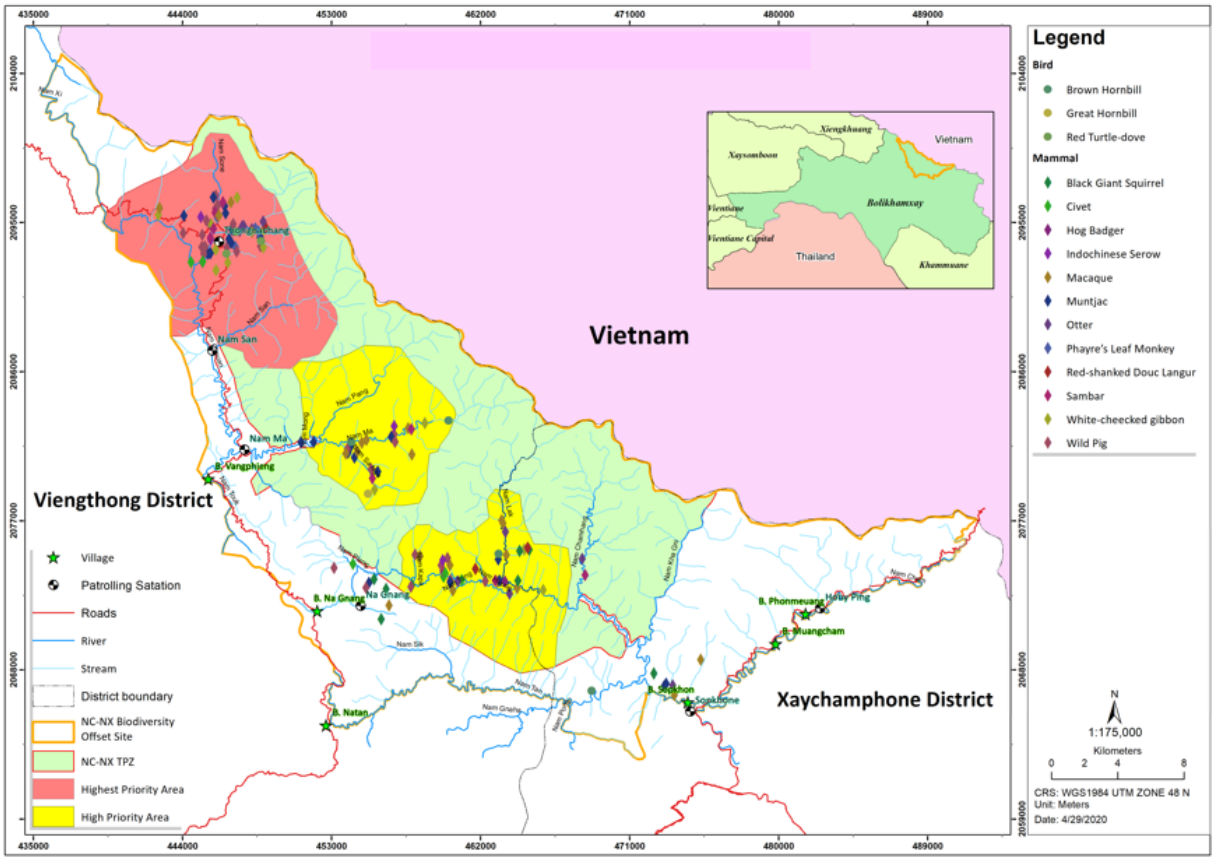


Figure 3-7: Fishing camp and dry rack observed at Nam Houng area	*Figure 3-8: Wild pigs were observed at Nam Houng area*
	

c. Component 4 – Conservation linked livelihood development

A contractual agreement with the new Consultant for preparing the NC-NX Community Development Plan (CDP) was signed on 08 April 2020. A draft inception report was finalized on 30 April 2020 and will be further discussed with Bolikhamxay Provincial BOMU and BSP team in May 2020.

3.6 FLOATING DEBRIS REMOVAL

There was no field works carried out in April 2020 due to city lockdown for COVID-19 prevention.

4. FISHERY MONITORING

Three species groups and two species dominated the fish catch by weight in March 2020 as listed in ***Table 4-1.*** All species are classified as Least Concern (LC) according to the IUCN Red List of Threatened Species[1], except *Tor sinensis* is classified as Vulnerable species and *Sikukia gudgeri* is classified as Data Deficient (DD).

TABLE 4-1: FISH SPECIES DOMINATING THE FISH CATCH IN MARCH 2020

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
Hampala dispar, Hampala macrolepidota	ปาสูด	250.7	LC
Poropuntius normani, Poropuntius laoensis, Poropuntius carinatus	ปาจาด	128	LC
Channa striata	ปาถ่ำ	123.4	LC
Tor sinensis	ปาแดง	88.3	VU
Sikukia gudgeri, Amblyrhynchichthys truncatus	ปาขาวซาย	100.6	DD, LC

The recorded catch of Threatened and Near Threatened species (IUCN Red List classification) in March 2020 is presented in ***Table 4-2***. The list includes four species that are classified as Vulnerable (VU) species and two Near Threatened (NT) species.

TABLE 4-2: THREATENED SPECIES OF MARCH 2020 FISH CATCH

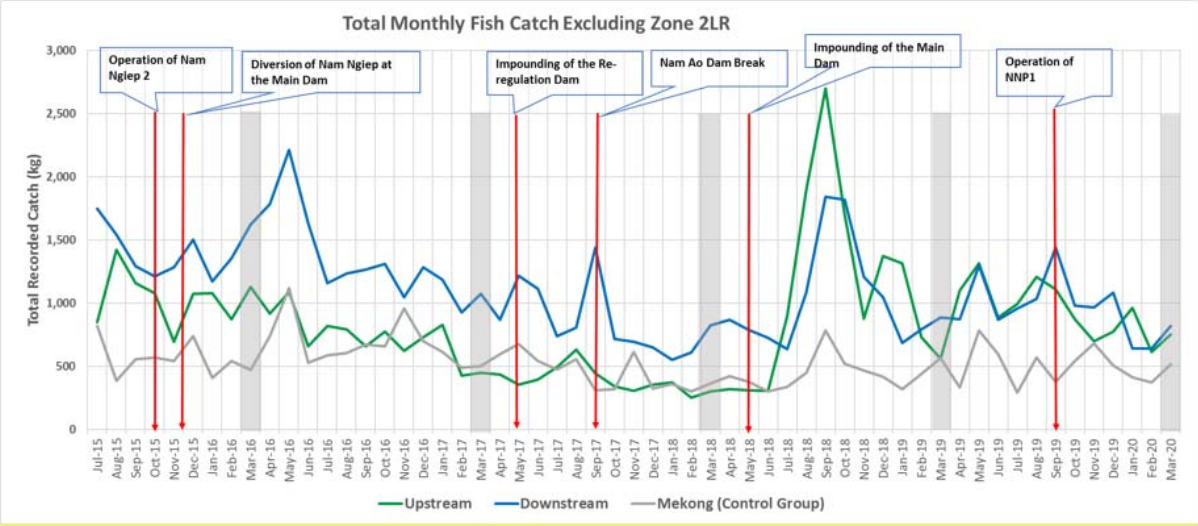
Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
Cirrhinus cirrhosus	ปามอมจัม/ปาแกง	0.4	VU
Cyprinus carpio	ปาไม	8	VU

[1] 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.

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
Neolissochilus stracheyi	ปาสอง	1.2	NT
Onychostoma gerlachi	ปาถิ่ง	14.1	NT
Scaphognathops bandanensis	ปาอวมไฟ/ปาข่วม	9.2	VU
Tor sinensis	ปาแดง	88.3	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 March 2020 is presented in *Error! Not a valid bookmark self-reference.*. 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 – MARCH 2020



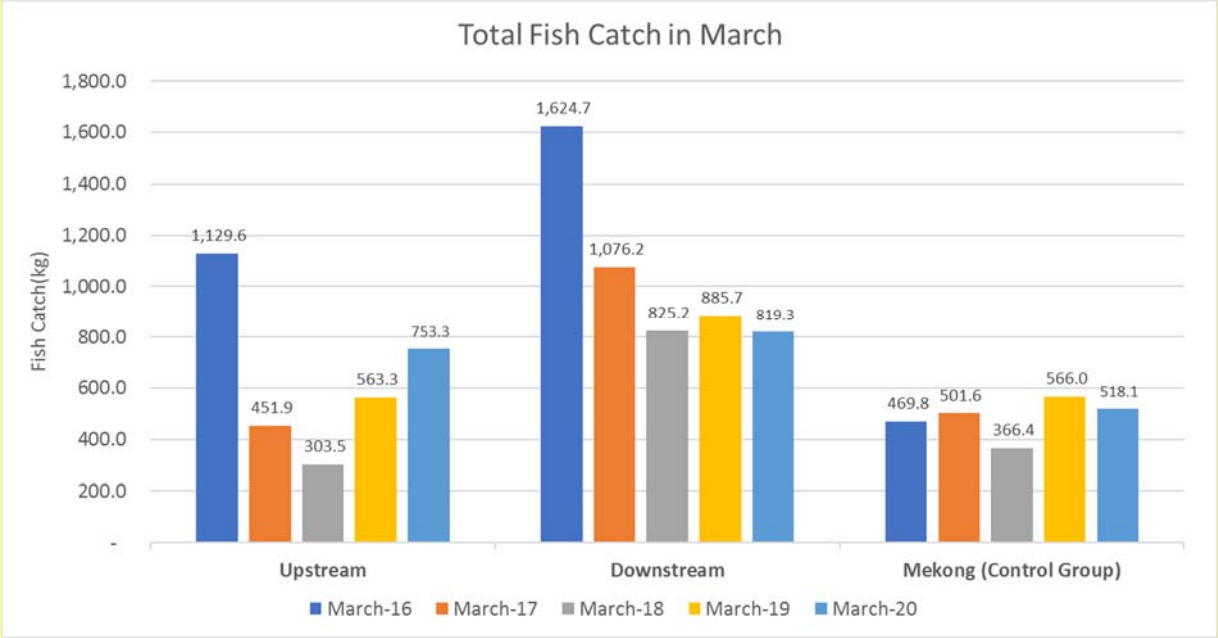
Error! Reference source not found. and *Error! Reference source not found.* show the total recorded fish catch for March 2016, March 2017, March 2018, March 2019 and March 2020 in the upstream (excluding Zone 2LR) and downstream communities and the Mekong control group. The total fish catch data represents the total fish supply provided by the involved fishing households.

Table 4-3: TOTAL FISH CATCH BY UPSTREAM (EXCLUDING ZONE 2LR), DOWNSTREAM AND MEKONG CONTROL GROUP FISHING HOUSEHOLDS IN MARCH 2016, MARCH 2017, MARCH 2018, MARCH 2019 AND MARCH 2020

Fishing Zone	March 2016 (kg)	March 2017 (kg)	March 2018 (kg)	March 2019 (kg)	March 2020 (kg)
Upstream	1,129.6	451.9	303.5	563.3	753.3
Downstream	1,624.7	1,076.2	825.2	885.7	819.3

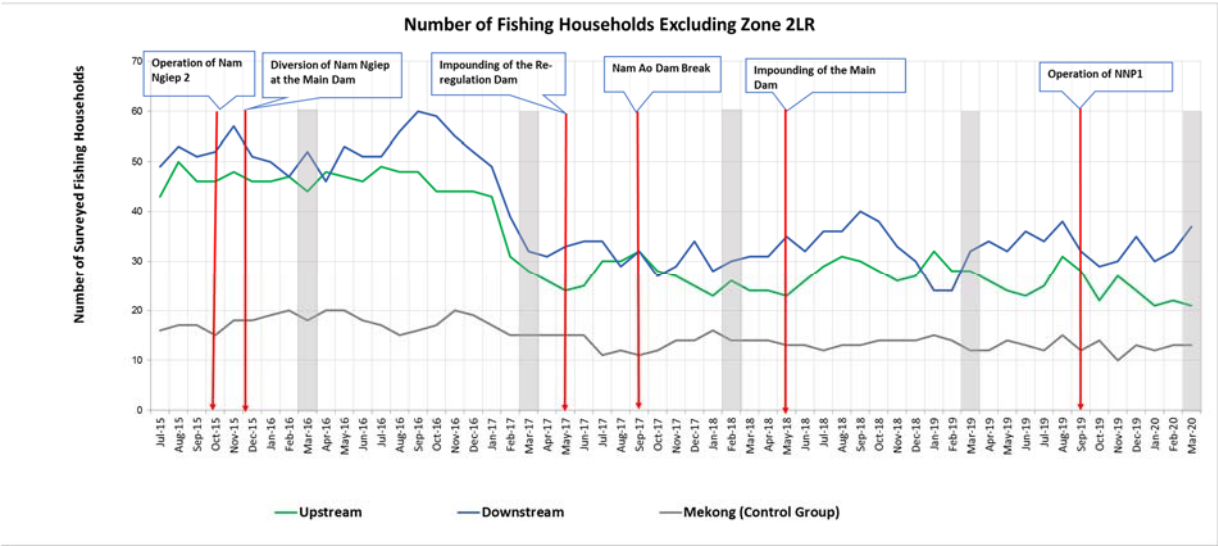
Fishing Zone	March 2016 (kg)	March 2017 (kg)	March 2018 (kg)	March 2019 (kg)	March 2020 (kg)
Mekong Control Group	469.8	501.6	366.4	566.0	518.1

FIGURE 4-2: TOTAL FISH CATCH BY UPSTREAM (EXCLUDING ZONE 2LR), DOWNSTREAM AND MEKONG CONTROL GROUP FISHING HOUSEHOLDS IN MARCH 2016, MARCH 2017, MARCH 2018, MARCH 2019 AND MARCH 2020



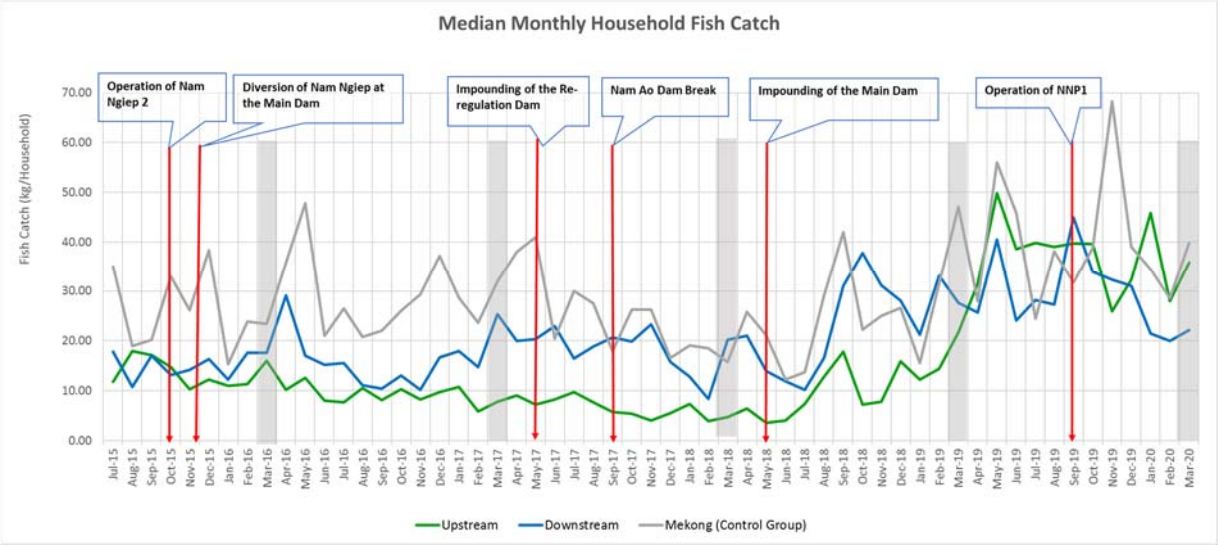
The numbers of fishing households involved in the fish catch monitoring programme are displayed in *Error! Not a valid bookmark self-reference.*.

FIGURE 4-3: NUMBER OF FISHING HOUSEHOLDS INVOLVED IN THE FISH CATCH MONITORING PROGRAMME



The median monthly household fish catch from July 2015 to March 2020 for the upstream (excluding Zone 2LR) and downstream communities, and the Mekong control group are presented in ***Figure below***.

FIGURE 4-4: MEDIAN MONTHLY HOUSEHOLD FISH CATCH WITHOUT ZONE 2LR



The median household fish catch for March 2016, March 2017, March 2018, March 2019 and March 2020 in the upstream (excluding Zone 2LR) and downstream communities and the Mekong control group are displayed in Table below**;**

TABLE 4-4: MEDIAN MONTHLY HOUSEHOLD FISH CATCH IN THE UPSTREAM AND DOWNSTREAM COMMUNITIES EXCLUDING ZONE 2LR

Fishing Zone	March 2016 (kg)	March 2017 (kg)	March 2018 (kg)	March 2019 (kg)	March 2020 (kg)
Upstream	16.0	7.9	3.6	21.7	35.9
Downstream	17.7	25.4	14.0	27.7	22.1
Mekong Control Group	23.4	32.0	21.1	47.2	39.9

The median daily fish catch per household are displayed in Figure 4-5 and the median fish catch per household per fishing day in March 2016, March 2017, March 2018, March 2019 and March 2020 are shown in Table below;

FIGURE 4-5: MEDIAN DAILY FISH CATCH PER HOUSEHOLD

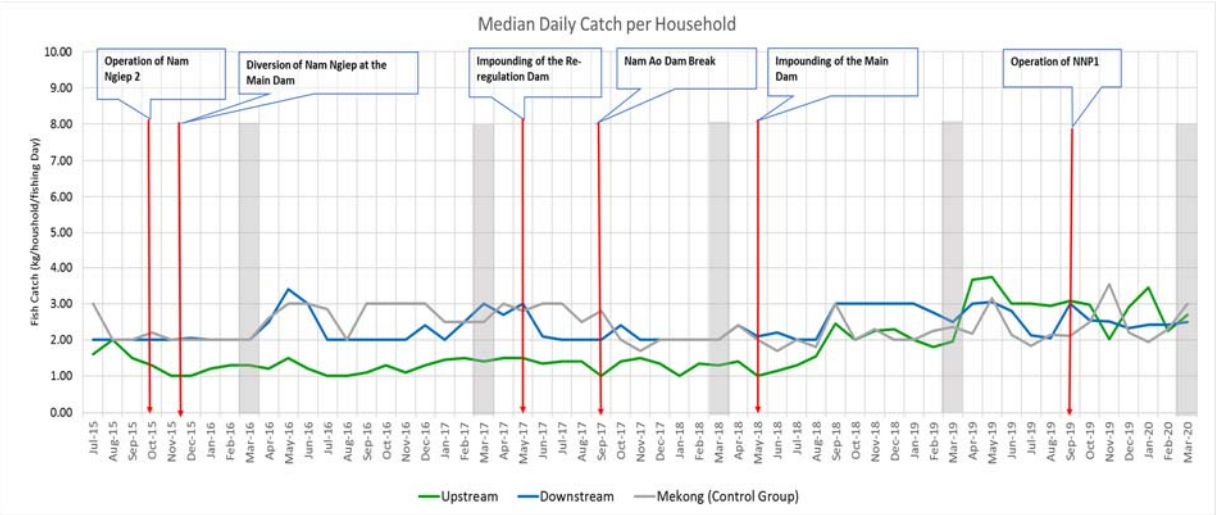


TABLE 4-5: MEDIAN DAILY FISH CATCH PER HOUSEHOLD IN MARCH 2020

Fishing Zone	March 2016 (kg)	March 2017 (kg)	March 2018 (kg)	March 2019 (kg)	March 2020 (kg)
Upstream	1.30	1.40	1.30	1.96	2.70
Downstream	2.00	3.00	2.00	2.50	2.50
Mekong (Control Group)	2.00	2.50	2.00	2.37	3.00

ANNEXES

ANNEX A: RESULTS OF WATER QUALITY MONITORING

TABLE A- 1: ***RESULTS OF MAIN RESERVOIR, RE-REGULATION RESERVOIR AND SURFACE WATER (NAM NGIEP RIVER) QUALITY MONITORING***

		River Name	Nam Ngiep											
		Zone	Location Refer to Construction Sites											
			Upstream/Main Reservoir						Within / Re-regulation Reservoir		Downstream			
		Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08
Date	Parameters (Unit)	Guideline												
1-Apr-20	pH	5.0 - 9.0						7.02	7.09		7.47		7.78	7.51
6-Apr-20	pH	5.0 - 9.0	7.02											
8-Apr-20	pH	5.0 - 9.0						7.2	6.66	6.68	6.85	6.93	7.14	7.17
9-Apr-20	pH	5.0 - 9.0		7.34	6.9	7.58	7.57							
21-Apr-20	pH	5.0 - 9.0						7.52	6.71	6.77	7.04		6.34	6.5
29-Apr-20	pH	5.0 - 9.0						7.36	7.06	6.85	6.92		7.29	7.38
1-Apr-20	Sat. DO (%)							108	49.8		96.8		95.1	99.7
6-Apr-20	Sat. DO (%)		104											
8-Apr-20	Sat. DO (%)							96.1	18.6	22.1	101.5	97.7	75.1	74.1
9-Apr-20	Sat. DO (%)			82	84.8	96.1	88.1							
21-Apr-20	Sat. DO (%)							89.3	18.7	46.7	78.3		72.7	53
29-Apr-20	Sat. DO (%)							83.6	27.1	25.8	28		57.9	70.4
1-Apr-20	DO (mg/L)	>6.0						8.6	4.17		8.02		7.5	7.8
6-Apr-20	DO (mg/L)	>6.0	8.03											
8-Apr-20	DO (mg/L)	>6.0						7.71	1.56	1.8	8.38	8.07	6.17	6.09
9-Apr-20	DO (mg/L)	>6.0		6.76	6.68	7.53	6.94							
21-Apr-20	DO (mg/L)	>6.0						6.98	1.53	3.79	6.43		5.84	4.25
29-Apr-20	DO (mg/L)	>6.0						6.62	2.27	2.07	2.34		4.75	5.59
1-Apr-20	Conductivity (µs/cm)							78	95		94		92	90
6-Apr-20	Conductivity (µs/cm)		57.8											
8-Apr-20	Conductivity (µs/cm)							76	92	85	98	87	88	83
9-Apr-20	Conductivity (µs/cm)			95	92	79	76							
21-Apr-20	Conductivity (µs/cm)							76	93	90	89		92	88
29-Apr-20	Conductivity (µs/cm)							75	94	91	95		92	90
1-Apr-20	Temperature (°C)							26.9	24.39		24.79		27.6	27.96
6-Apr-20	Temperature (°C)		26											
8-Apr-20	Temperature (°C)							26.68	24.03	25.23	24.99	24.86	25.35	25.69
9-Apr-20	Temperature (°C)			25.2	27.78	27.92	27.62							

		River Name	Nam Ngiep											
		Zone	Location Refer to Construction Sites											
			Upstream/Main Reservoir						Within / Re-regulation Reservoir		Downstream			
		Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08
Date	Parameters (Unit)	Guideline												
21-Apr-20	Temperature (°C)							28.11	26.15	27.39	25.29		27.02	26.64
29-Apr-20	Temperature (°C)							27.39	24.42	26.56	24.8		25.63	26.65
1-Apr-20	Turbidity (NTU)							1.67	3.03		9.48		16.01	7.82
6-Apr-20	Turbidity (NTU)		3.3											
8-Apr-20	Turbidity (NTU)							1.72	3.01	5.07	8.83	18.2	9.57	8.3
9-Apr-20	Turbidity (NTU)			48.3	1.72	1.62	1.29							
21-Apr-20	Turbidity (NTU)							2.29	4.54	6.35	5.64		10.46	10.19
21-Apr-20	Turbidity (NTU) - Hypolimnion							2.4						
29-Apr-20	Turbidity (NTU)							2.01	2.4	8.52	4.75		5.52	9.5
21-Apr-20	TSS (mg/L)							<5	<5	5.21	<5		15.2	26.49
21-Apr-20	TSS (mg/L) - Hypolimnion							<5						
21-Apr-20	BOD_5 (mg/L)	<1.5						<1	5.93	3.76	1.53		2.25	1.52
21-Apr-20	BOD_5 (mg/L) - Hypolimnion							<1.0						
21-Apr-20	Faecal coliform (MPN/100 mL)	<1,000						0	5	23	70		170	70
21-Apr-20	Faecal coliform (MPN/100 mL) - Hypolimnion							0						
21-Apr-20	Total Coliform (MPN/100 mL)	<5,000						17	140	350	450		1,600	920
21-Apr-20	Total Coliform (MPN/100 mL) - Hypolimnion							17						

TABLE A- 1: *RESULTS OF SURFACE WATER QUALITY MONITORING IN NAM CHIAN, NAM PHOUAN, NAM XAO AND NAM HOUAY SOUP*

		River Name	Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites			
			Tributaries Upstream		Tributaries Downstream	
		Station Code	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline				
6-Apr-20	pH	5.0 - 9.0	7.73			
8-Apr-20	pH	5.0 - 9.0			6.94	6.99
9-Apr-20	pH	5.0 - 9.0		7.56		
21-Apr-20	pH	5.0 - 9.0			7.27	
29-Apr-20	pH	5.0 - 9.0			6.91	
6-Apr-20	Sat. DO (%)		97			
8-Apr-20	Sat. DO (%)				79.5	100.9
9-Apr-20	Sat. DO (%)			99.7		
21-Apr-20	Sat. DO (%)				80.9	
29-Apr-20	Sat. DO (%)				75.2	
6-Apr-20	DO (mg/L)	>6.0	7.51			
8-Apr-20	DO (mg/L)	>6.0			6.89	8.23
9-Apr-20	DO (mg/L)	>6.0		7.96		
21-Apr-20	DO (mg/L)	>6.0			6.17	
29-Apr-20	DO (mg/L)	>6.0			5.82	
6-Apr-20	Conductivity (µs/cm)		23.1			
8-Apr-20	Conductivity (µs/cm)				116	46
9-Apr-20	Conductivity (µs/cm)			97		
21-Apr-20	Conductivity (µs/cm)				151	
29-Apr-20	Conductivity (µs/cm)				188	
6-Apr-20	Temperature (°C)		25.9			
8-Apr-20	Temperature (°C)				26.26	25.61
9-Apr-20	Temperature (°C)			26.68		
21-Apr-20	Temperature (°C)				29.68	
29-Apr-20	Temperature (°C)				28.6	
6-Apr-20	Turbidity (NTU)		6.7			
8-Apr-20	Turbidity (NTU)				25.1	22.62
9-Apr-20	Turbidity (NTU)			6.17		
21-Apr-20	Turbidity (NTU)				6.27	
29-Apr-20	Turbidity (NTU)				4.21	
21-Apr-20	TSS (mg/L)				7.8	
21-Apr-20	BOD_5 (mg/L)	<1.5			<1	
21-Apr-20	Faecal coliform (MPN/100 mL)	<1,000			280	
21-Apr-20	Total Coliform (MPN/100 mL)	<5,000			1,600	

ANNEX B: RESULTS OF EFFLUENT ANALYSES

TABLE B-1: *RESULTS OF CAMP EFFLUENTS IN APRIL 2020*

	Site Name	Owner's Site Office and Village (OSOV1)	OSOV2 (ESD Camp 2)	OSOV2 (ESD Camp 1)	Main Powerhouse
	Station Code	EF01	EF13	EF14	EF19
	Date	23-Apr-20	23-Apr-20	23-Apr-20	23-Apr-20
Parameters (Unit)	**Guideline**				
pH	6.0 - 9.0	6.21	6.38	6.25	
Sat. DO (%)		40.7	13.6	43.5	No effluent camp water during the mission.
DO (mg/L)		3.11	1.03	3.3	
Conductivity (µs/cm)		319	367	348	
TDS (mg/L)		159.5	183.5	174	
Temperature (°C)		28	28.2	28.2	
Turbidity (NTU)		1.72	7.83	11.09	
TSS (mg/L)	<50	0.8	16.7	12	
BOD_5 (mg/L)	<30	<6	37.95	<6	
Total coliform (MPN/100 mL)	<400	920	16,000	13	
Faecal Coliform (MPN/100 mL)	<400	47	16,000	2	
Effluent Discharge Volume (L/mn)		10	4	1	
Chlorination Dosing Rate (mL/mn)		n/a	12	5	
Residual Chlorine (mg/L)	<1.0	n/a	0.1	0.67	