NAM NGIEP 1
POWER COMPANY

Nam Ngiep 1 Hydropower Project

Environmental Management
Monthly Monitoring Report

January 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 January 2020, the Environmental Management Office (EMO) of Nam Ngiep 1 Power Company (NNP1PC) received two Site Specific Environmental and Social Management Plans (SS-ESMMP) and three Site Decommissioning and Rehabilitation Plans for review and approval.

The monthly site visit by the Bolikhan District EMU (Bolikhamxay Province) was not carried out in December 2019. However, a quarterly mission of EMU Xaysomboun Province was conducted during 14-17 January 2020 in Hom District (Hom Thard and Nam Khian Villages) and Thathom District (Pou Village) on the livelihood program for self-resettlement. A site inspection report will be submitted to NNP1PC for review and comments by the end of January 2020.

The effluent monitoring results for the camps in January 2020 indicate that the results of ammonia nitrogen and total nitrogen continue to fluctuate over the month and comply with the relevant effluent standards for some camps. NNP1PC is in the process of hiring an external consultant to assess and evaluate the design and operation of the existing WWTS at the ESD camps (former IHI and HM Hydro Camps) and to provide an improved design using a more permanent technology. The expert is likely to be on board by February 2020.

The Dissolved Oxygen (DO) levels at the surface of the Main Reservoir (R1, R2, R3, R4 and R5) were generally between 1 mg/L and 9 mg/L. In the Re-regulation Reservoir (R6 and R7), the DO was generally below 4 mg/L during the period.

The discharge from the re-regulation dam alternated between discharges from the gate and turbine. All DO concentrations (except on 16 January 2020) were less than 6 mg/L at Nam Ngiep downstream stations and not in compliance with the National Standard. However, no dead fish were observed in Nam Ngiep downstream during 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. In addition, it is testing a combined discharge of water from the gate and turbine to observe the water quality downstream taking into account the lag time.

A total of 10.5 m^3 of solid waste was disposed of at the NNP1 Project Landfill, a decrease of 33.5 m^3 compared to December 2019 due to the decommissioning of Song Da5 camp no 1 and OC camp. A total of 2,751 kg of recyclable waste was recorded at the Community Waste Bank. A total of 4 m^3 of solid waste from Phouhomxay, Thahuea and Hat Gniun Villages was disposed of at the Houay Soup Landfill. NNP1PC is in the process of procuring a new local contractor to support the waste collection, disposal and delivery from the Project areas to NNP1 Project Landfill as well as from the host villages and Phouhomxay Village to Houay Soup Landfill. It is expected that the contractor will be contracted by February 2020.

NNP1PC is processing the procurement of office and field equipment under NNP1PC additional No Net Loss (NNL) commitment to support the WRPO of Xaysomboun and Bolikhamxay Provinces in implementing the activities of AIP2019. The field activities such as forest patrol in Bolikhamxay Province started at the end of January 2019 and field verification of TPZ boundary in Xaysomboun Province were scheduled to start after receiving the NNL fund from DOF.

Biodiversity offset related activities under the components of spatial planning and regulation, law enforcement, and conservation linked livelihood continued in January 2020 whilst other activities are subject to the approval of NC-NX AIP2020. The draft of AIP2020 was finalized by NC-

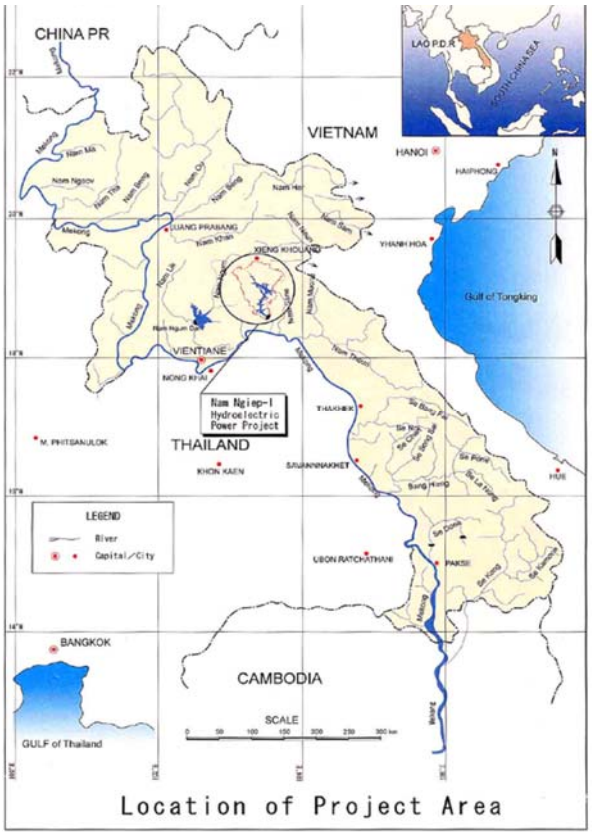
NX BOMU on 15 January 2020. The draft was further reviewed and improved by NNP1PC on 24 January 2020.

The fish catch monitoring for December 2019 in Nam Ngiep watershed was dominated *Oreochromis niloticus*, *Channa striata*, and species groups of Poropuntius, Hampala, and Sikukia *gudgeri, Amblyrhynchichthys* truncatus that are classified as Least Concern (LC) according to the IUCN Red List, except *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 7 FEBRUARY 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	480	99	5,507,375	5,307,375	96	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.

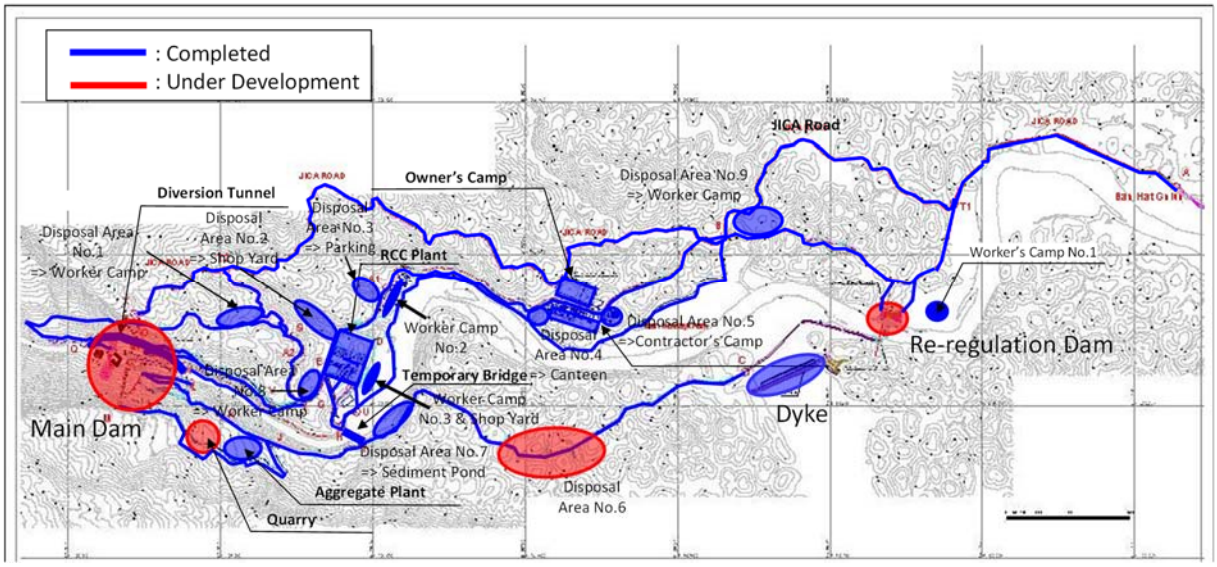
The repairs to the foundation of leg 4 of 230 kV TL Tower No.1 were completed in February 2019. The remaining excavation of the plunge pool was finished in January 2019. The reinforced concrete parapet wall was completed in December 2018 and road deck to the main dam crest and the concrete spillway chutes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

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 2-4: Quarry Area View

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 July 2019 was 98.8 % (compared to planned progress of 100.0 %). This apparent delay is simply due to the delay to issuing of the Taking-Over Certificate for the main powerhouse.

The main activities carried out during this month are described below:

Figure 4.2-1: Removing of servo amplifier and modifying wiring circuit

Figure 4.2-2: Uploading the new logic to the governor system

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 January 2020, the Environmental Management Office (EMO) of Nam Ngiep 1 Power Company (NNP1PC) received two Site Specific Environmental and Social Management Plans (SS-ESMMP), and three Site Decommissioning and Rehabilitation Plans for review and approval.

TABLE 3-1: SS-ESMMP AND DOCUMENTS REVIEW STATUS IN JANUARY 2020

Title	Date Received	Status
Site Decommissioning and Rehabilitation Plan for Song Da5, Temporary CVC Batching Plant and Stockyard	06 January 2020 (2nd submission)	Under review
DWP & SS-ESMMP for Supply and Installation of the Transmission Line Tower No.1	06 January 2020 (1st submission)	No objection with comments on 09 January 2020.
Site Decommissioning and Rehabilitation Plan for Song Da 5 Camp No.1	06 January 2020 (2nd submission)	No objection with no further comments on 30 January 2020.
DWP & SS-ESMMP for supply and installation of log booms at main dam and re-regulation dam	17 January 2020 (1st submission)	No objection with comments on 30 January 2020.
Site Decommissioning and Rehabilitation for VSP Camp and Spoil Disposal Area of HSRA Irrigation Canal.	29 January 2020 (1st submission)	Under review

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 December 2019	2	0	0	0
Newly Opened in January 2020	1	0	0	0
Total in January 2020	**7**	**0**	**0**	**0**
Resolved in January 2020	2	0	0	0
Carried over to February 2020	1	0	0	0

Unsolved Exceeding Deadlines	**0**	**0**	**0**	**0**

3.1.1 Inspection by Environment Management Unit

The monthly site visit by the Bolikhan District EMU was not carried out during January 2020. A quarterly mission by the EMU of Xaysomboun Province was conducted during 14-17 January 2020 in Hom District (Hom Thard and Nam Khian Villages) and Thathom District (Pou Village) on the livelihood programme for self-resettlement. The site inspection report will be submitted for NNP1PC comment by the end of January 2020.

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/

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 January 2020 indicate that all the camps complied with the standards for total coliform and faecal coliform. However, the results of ammonia nitrogen and total nitrogen continue to fluctuate over the month and comply with the relevant effluent standards for some camps.

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

Table 3-3: Status of Corrective Actions for Non-Compliances at Camps and Construction Sites

Site	Sampling ID	Status	Corrective Actions
Owner's Site Office and Village (OSOV)	EF01	Non-compliance for ammonia nitrogen in the second fortnight.	NNP1PC will undertake major maintenance of the WWTS in February – March 2020.
Song Da5 Camp No. 1	EF07	No effluent discharge. The camp is under decommissioning	
ESD Camp (HM Hydro Main Camp)	EF13	Non-compliance for total nitrogen and ammonia-nitrogen.	An external expert is being hired to evaluate the design and operation of the existing WWTS and to provide an improved

Site	Sampling ID	Status	Corrective Actions
			design using a more permanent technology.
ESD Camp (former IHI Main Camp)	EF14	Non-compliance for total nitrogen and ammonia nitrogen.	An external expert is being hired to evaluate the design and operation of the existing WWTS as well as providing an improved design using a more permanent technology.
Main Powerhouse	EF19	Non-compliance for total nitrogen and ammonia nitrogen.	As above.
Spoil Disposal Area No.2	DS04	Non-compliance for pH on 16 January 2020.	The low pH has been a natural characteristic of the water which flows through this area during the dry season since the start of the Project
Upstream Spoil Disposal Area No.2	DS04-US	Non-compliance for pH on 16 January 2020.	The low pH has been a natural characteristic of the water which flows through this area during the dry season since the start of the Project

3.2.2 AMBIENT SURFACE WATER QUALITY MONITORING

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

TABLE 3-4: MONITORING FREQUENCY FOR SURFACE WATER QUALITY PARAMETERS

Frequency of Monitoring	Parameters (Unit)	Monitoring Sites
Wednesday and Friday (Intensive Monitoring)	pH, DO (%), DO (mg/L), Conductivity (µs/cm), TDS (mg/L), Temperature (°C) and Turbidity (NTU)	- R5, main reservoir immediately upstream the main dam; - Tailrace main dam; - Re-regulation reservoir: R6 and R7; - Tailrace re-regulation dam; - Nam Ngiep at the bridge; - NNG05, Nam Ngiep downstream of the re-regulation dam at Hat Gniun Village
Weekly	pH, DO (%), DO (mg/L), Conductivity (µs/cm), TDS (mg/L), Temperature (°C), Turbidity (NTU).	- Main Reservoir: R1, R2, R3, R4, R5; - Nam Ngiep downstream: NNG05, NNG06, NNG07 and NNG08; - Tributaries: Nam Phouan [NPH01], Nam Xao [NXA01] and Nam Houay Soup [NHS01].
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), Hydrogen sulphide (mg/L), Phytoplankton biomass, TOC and TKN.	As per ESMMP-OP.

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

Main Reservoir

During January 2020, the water level in the main reservoir decreased from El. 311 m asl. to El. 309 m asl.

At R5, during 03-23 January 2020, the DO level in the upper 10.0 m was generally between 6 mg/L and 9 mg/L, and the entire water column below 18.0 m had a DO level of less than 1 mg/L. In addition, on 28 and 30 January 2020, the DO concentration for the entire water column was between 0.10 mg/L and 2.0 mg/L.

At R4, the DO concentrations in the upper 8.0 m was generally between 4 mg/L and 8 mg/L, and in the entire water column below 14.0 m had a DO concentration of less than 1 mg/L.

The DO concentrations at R3 were recorded between 5 mg/L and 9 mg/L in the upper 4.5 m. The concentration of DO in the water column below 9.5 m was generally less than 1 mg/L, however, with some occasional spikes at between 30 m to 36 m depth of 2.10 mg/L to 3.05 mg/L.

The DO concentrations at R2 generally fluctuated between 0.07 mg/L and 9.22 mg/L in the entire water column.

At R1, the DO level was generally between 6 mg/L and 10 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 measurements in January 2020 were within the standard and some of the measurements were below the limit of detection, except at R3.

Re-regulation Reservoir

In January 2020, the turbine discharge from the main dam varied between 9 m^3/s and 146 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 below 1 mg/L to about 4 mg/L in the entire water column.

Similar to previous months since the start of commercial operation in September 2019, elevated levels of BOD_5 ranging from about 5 mg/L to 6 mg/L were measured in R6 and R7 in January 2020.

Downstream

During January 2020, the discharge from the re-regulation dam alternated between discharges from the gate and turbine. All DO concentrations (except on 16 January 2020) were less than 6 mg/L at the Nam Ngiep Downstream stations and thus non-compliant with the National Standard. No dead fish were observed in Nam Ngiep downstream during 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. In addition, it is testing a combined discharge of water from the gate and turbine to observe the water quality downstream taking into account the lag time.

Elevated levels of BOD_5 ranging from about 1 mg/L to 3 mg/L were measured in the downstream stations with the highest concentrations in the stations close to the dam and then gradually tapering off.

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

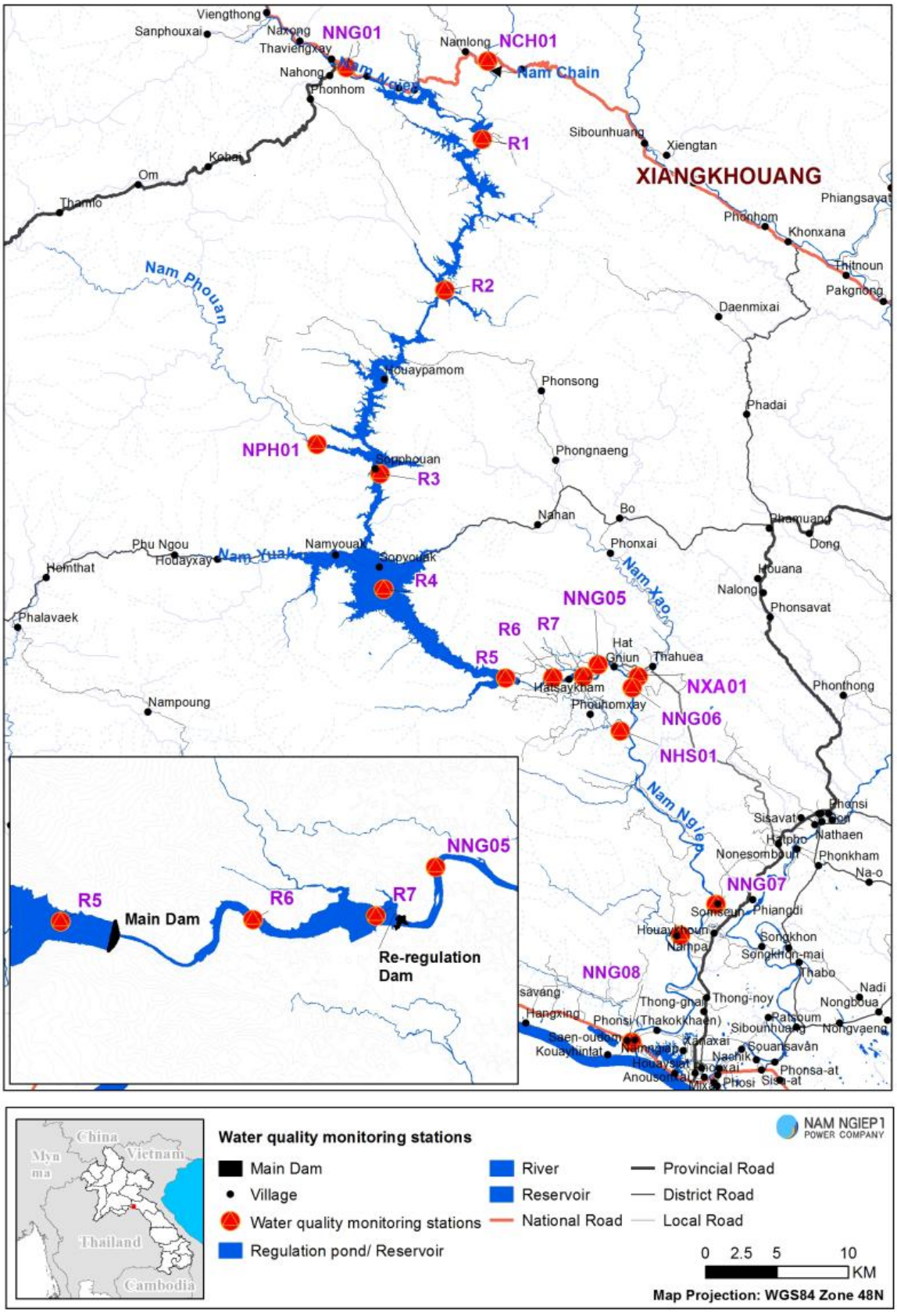


FIGURE 3-2: CONCENTRATION OF DISSOLVED OXYGEN IN THE UPPER 0.2 M SINCE THE START OF IMPOUNDING

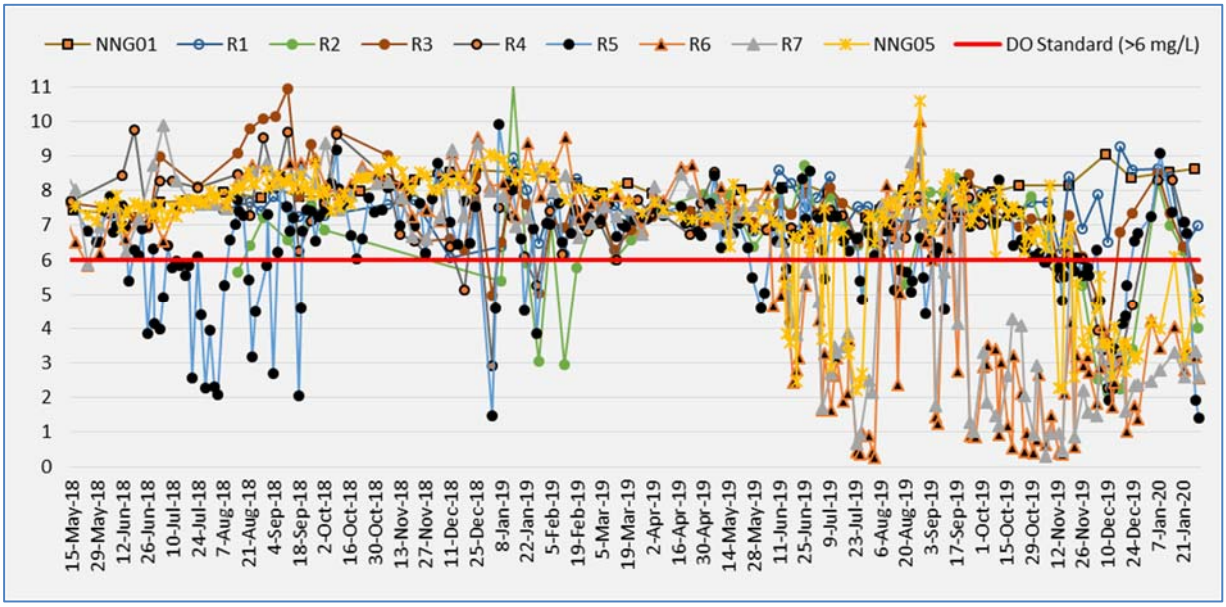


TABLE 3-5: *RESULTS OF SURFACE WATER QUALITY MONITORING FOR DISSOLVED OXYGEN (MG/L) IN THE UPPER 0.2 M, WATER QUALITY STANDARD: >6.0 MG/L*

DO (mg/L)	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
3-Jan-20						7.24	4.23	2.46	4.18	3.62	5.57	6.23			7.61	6.2
7-Jan-20		8.63	8.25	8.5	8.3									9.3		
8-Jan-20						9.07	3.42	2.79	3.97	3.63	5.0	5.53			6.23	5.62
13-Jan-20	8.54												8.15			
14-Jan-20		8.41	6.98	7.4										6.7		
15-Jan-20					8.3	7.39										
16-Jan-20							4.04	3.3	6.09	6.21	6.04	6.29			6.53	6.31
21-Jan-20		6.32	6.26	6.4	7.1									7.4		
22-Jan-20						7.1	2.78	2.58	3.18	3.14	4.63	5.16			6.14	6.03
23-Jan-20						6.76	3.32	3.1	3.51	3.77	4.61	5.18			6.17	6.46
27-Jan-20	8.63												8.27			
28-Jan-20						1.91	3.16	3.34	5.01	4.83	5.65	6.11			6.23	6.1
29-Jan-20		7.01	4.02	5.4	4.9									7.8		
30-Jan-20						1.4	2.56	2.6	4.49	4.35	5.23	6.22			6.84	6.12

TABLE 3-6: *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
13-Jan-20	<5												<5			
14-Jan-20		5.9	<5	<5										34.08		
15-Jan-20					<5	<5										
16-Jan-20							28.53	8.13	6.04	10	<5	11.2			7.15	<5

TABLE 3-7: *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
13-Jan-20	<1.0												<1.0			
14-Jan-20		1.3		1.9										<1.0		
15-Jan-20					<1.0	<1.0										
16-Jan-20							6.36	5.26	1.17	2.63	3.35	1.04			1.84	2.03

3.2.3 GROUNDWATER QUALITY MONITORING

During January 2020, community groundwater quality analyses were carried out for three wells located in Somseun Village, Nam Pa Village and Thong Noy Village. There was no water sampling for Pou Village due to the fact that a water pump was broken.

Most results of community groundwater complied with the groundwater quality standards for water supply purposes, except some low content of faecal coliform and E.Coli bacteria as presented in below Table.

TABLE 3-8: GROUNDWATER QUALITY MONITORING RESULTS IN SOMSUEN, NAM PA, THONG NOI AND POU VILLAGES

Parameter (Unit)	Site Name	Somseun Village	NamPa Village	ThongNoy Village	Pou Village
	Station	GSXN01	GNPA01	GTHN01	GPOU01
	Guideline				
pH	6.5 - 9.2	6.81	6.7	6.92	No sampling due to water pump was broken.
Sat. DO (%)		80.4	82.8	78.8	
DO (mg/l)		6.51	6.66	6.41	
Conductivity (µS/cm)		301	310	308	
Temperature (°C)		23.7	23.2	24.8	
Turbidity (NTU)	<20	3.4	2.1	3.9	
Fecal coliform (MPN/100 ml)	0	2	11	2	
E.coli Bacteria (MPN/100 ml)	0	2	11	2	

3.2.4 GRAVITY FED WATER SUPPLY (GFWS) QUALITY MONITORING

During January 2020, water samples from water taps at Hat Gniun Village and Phouhomxay Village were analysed. The WPHX01 represents raw water in the head tank before the filtration system.

The results of the water quality analyses are presented in Table 3-9. All parameters complied with the National Drinking Water Standards except for faecal coliforms and E. Coli at WTHH02, WHGN02, WPHX01 (intake), WPHX02 (tap water at the primary school in Phouhomxay Village) and WPHX03 (tap water at a house in Phouhomxay Village). The villagers generally use tap water for washing and cleaning. They were informed about the results and were encouraged to boil the water before drinking.

TABLE 3-9: RESULTS OF THE GRAVITY FED WATER SUPPLY QUALITY MONITORING

		Site Name	Thaheau Village	Hat Gnuin Village	Phouhomxay Village		
		Station	WTHH02	WHGN02	WPHX01	WPHX02	WPHX03
Date	Parameter (Unit)	Guideline					
20-Jan-20	pH	6.5 – 9.0			6.69	6.21	6.18
21-Jan-20	pH	6.5 – 9.0	7.23	7.12			
20-Jan-20	Sat. DO (%)				92.7	94	91.7
21-Jan-20	Sat. DO (%)		101.5	99.9			
20-Jan-20	DO (mg/L)				7.67	7.37	7.16
21-Jan-20	DO (mg/L)		8.52	7.66			
20-Jan-20	Conductivity (µS/cm)	<1,000			18.2	13.13	12.58
21-Jan-20	Conductivity (µS/cm)	<1,000	40	70			
20-Jan-20	Temperature (°C)	<35			24.6	26.5	26.7
21-Jan-20	Temperature (°C)	<35	2.99	1.01			
20-Jan-20	Turbidity (NTU)	<10			1.27	1.16	1.36
21-Jan-20	Turbidity (NTU)	<10	2.99	1.01			
20-Jan-20	Faecal Coliform (MPN/100 ml)	0			79	170	220
21-Jan-20	Faecal Coliform (MPN/100 ml)	0	11	110			
20-Jan-20	E.coli Bacteria (MPN/100 ml)	0			49	170	170
21-Jan-20	E.coli Bacteria (MPN/100 ml)	0	6.8	49			

3.2.5 LANDFILL LEACHATE MONITORING

During January 2020, the landfill leachate monitoring was conducted at NNP1 Project Landfill (Last pond - LL4) and at Houay Soup Solid Waste Landfill (Last pond - LL6).

The results indicate that Houay Soup Landfill did not comply with the standard for COD. However, the leachate was contained in the leachate ponds without discharging to the environment. EMO will continue to monitor the results and report in the next MPR. The landfill leachate monitoring results for January 2020 can be found in Table below.

***Table 3-10*: RESULTS OF THE LANDFILL LEACHATE MONITORING**

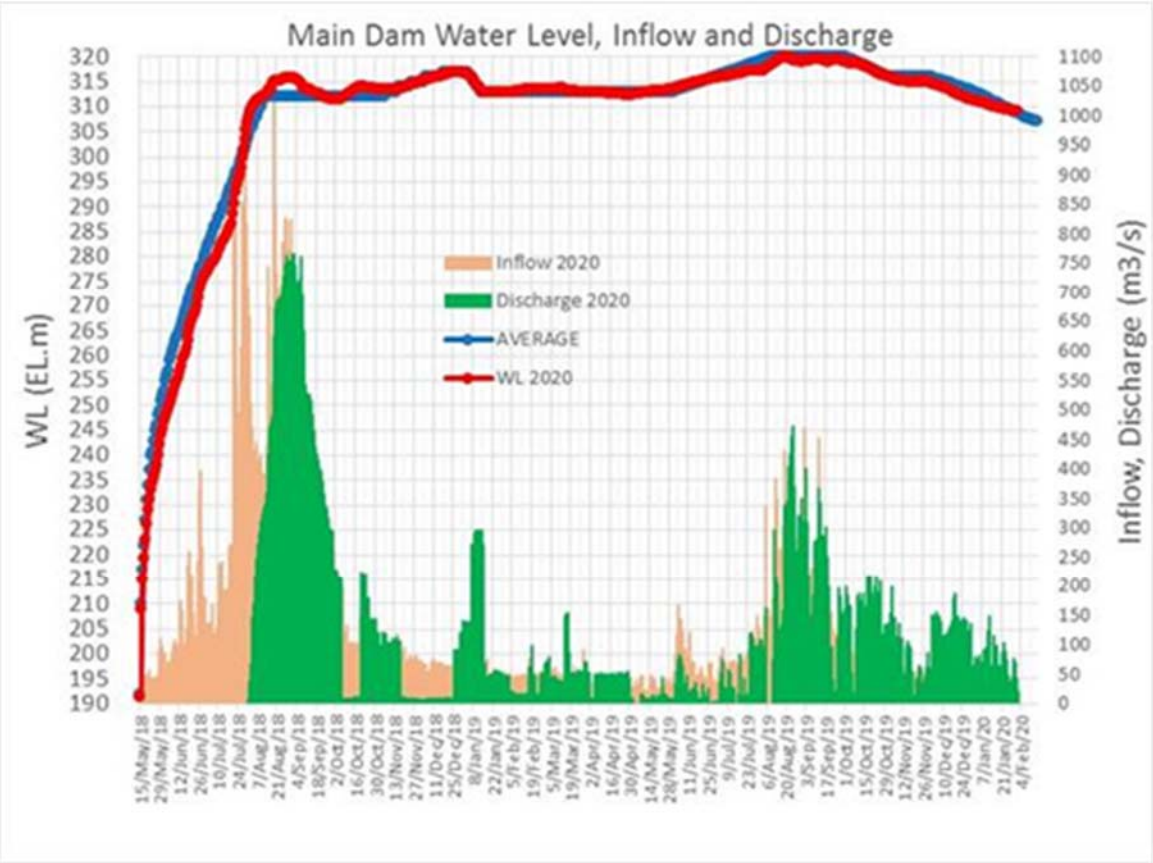
		Site Name	NNP1 Landfill Leachate					Houay Soup Landfill	
		Location	Pond No.01	Pond No.02	Pond No.03	Pond No.04	Discharge Point	Last pond	Discharged Point
		Station	LL1	LL2	LL3	LL4	LL5	LL6	LL7
Date	Parameter (Unit)	Guideline							
6-Jan-20	pH	6.0-9.0				7.49		8.76	
6-Jan-20	Sat. DO (%)					147.1		256.8	
6-Jan-20	DO (mg/L)					10.49		18.8	
6-Jan-20	Conductivity (µS/cm)					203.5		451	
6-Jan-20	TDS (mg/L)					101		225.5	
6-Jan-20	Turbidity (NTU)					4.59		16.2	
6-Jan-20	BOD_5 (mg/L)	<30				<6		28.8	
6-Jan-20	COD (mg/L)	<125				93.3		206	
6-Jan-20	Faecal Coliform (MPN/100 ml)	<400				0		0	
6-Jan-20	Total Coliform (MPN/100 ml)	<400				17		8	
6-Jan-20	Total nitrogen (mg/L)	<10				1		1	
6-Jan-20	Lead (mg/L)	<0.2				<0.031		<0.031	
6-Jan-20	Copper (mg/L)					<0.006		<0.006	
6-Jan-20	Iron (mg/L)					1.29		1.2	
6-Jan-20	Ammonia nitrogen (mg/L)	<10				<2		<2	

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 1-3.

During January 2020, the mean inflow to the main reservoir was 31 m3/s (min 18 m3/s and max 45 m3/s). During January 2020, the water level in the main reservoir decreased with 2 m from El. 311 m asl. to El. 309 m asl.

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

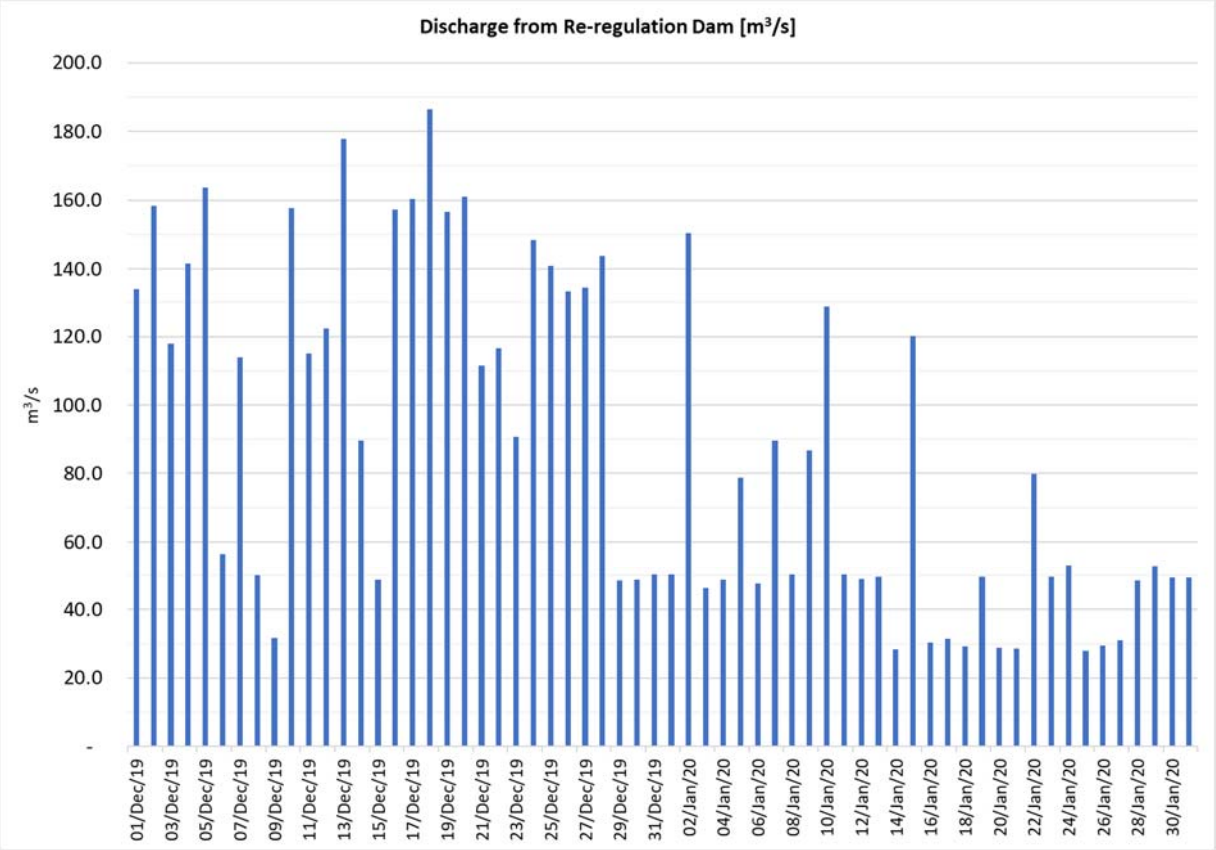


The discharge monitoring data for the re-regulation dam during December 2019 and January 2020 is presented in ***Figure 3-4***.

During January 2019, the mean discharge from the re-regulation dam was about 55 m3/s interrupted by short periods – usually on Sundays - with discharge about 30 m3/s. The discharge was kept above the minimum flow requirement of 27 m3/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 DECEMBER 2019 AND JANUARY 2020



3.2.7 NAM NGIEP DOWNSTREAM WATER DEPTH MONITORING

In January 2020, EMO carried out four boat missions 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 January 2020, a total of 10.5 m3 of solid waste was disposed of at the NNP1 Project Landfill, a decrease of 33.5 m3 compared to December 2019 due to the decommissioning of Song Da5 camp no. 1 and OC camp. During January, EMO conducted a waste management toolbox on NNP1 project landfill operation and the project's waste management hierarchy for the two new contractors: Vorarath Construction Company and Powergrid Company.

The main contractors / sub-contractor camps and facilities are decommissioned. There was no buying/selling activities of recyclable waste in the project site during the reporting period as no remaining recyclable waste on site after the decommissioning.

TABLE 3-11: AMOUNTS OF RECYCLABLE WASTE SOLD

Source and Type of Recycled Waste		Unit	Sold	Cumulative Total by January 2020
Construction Activity				
1	Scrap metal	kg	0	0
Sub-Total 1		**kg**	**0**	**0**
Camp Operations				
2	Glass bottles	kg	0	0
3	Plastic bottles	kg	0	0
4	Paper/Cardboard	kg	0	0
5	Aluminium cans	kg	0	0
Sub-Total 2		**kg**	**0**	**0**
Grand Total 1+2		**kg**	**0**	**0**

The local villagers collected a total of 630 kg of food waste from the OSOV for animal feed in January 2020, a decrease of 1,176 kg compared to December 2019 as a result of Song Da5 camp No.1, OBYASHI camp and LILAMA 10 camp are decommissioned.

TABLE 3-12: AMOUNTS OF FOOD WASTE COLLECTED BY VILLAGERS

No.	Site Name	Unit	Total
1	OSOV	kg	630
Total		**kg**	**630**

3.3.2 HAZARDOUS MATERIALS AND WASTE MANAGEMENT

The types and amounts of hazardous material and hazardous waste stored on site in January 2020 are shown in below**Error! Reference source not found.**

TABLE 3-13: RESULTS OF HAZARDOUS MATERIAL INVENTORY

No.	Hazardous Waste Type	Unit	Total in January 2020 (A)	Used (B)	Remainder (A - B)
1	Diesel (fuel)	Litre (L)	6239	5726	513
2	Lubricants (turbine oil)	Litre (L)	6400	0	6400
3	Grease oil	Drum (30 L)	7	0	7
4	Gear oil	Litre (L)	100	0	100
5	Thinner	Drum (25 L)	1	0	1
6	Colour paint	Can (3 L)	1	0	1
7	Sika	Can (0.5 L)	7	0	7
8	Fire extinguishers (18.5 kg)	Unit	8	0	8
9	Aluminium sulfate	Litre (L)	0	0	0
10	Chlorine powder	Kg	25	1	24
11	Chlorine liquid	Litre (L)	40	3	37

TABLE 3-14: RESULTS OF HAZARDOUS WASTE INVENTORY

No.	Hazardous Waste Type	Unit	Total in January 2020 (A)	Dispose (B)	Remainder (A - B)
1	Use oil	Litre (L)	2050	0	2050
2	Ink cartridge	Unit	179	72	107
3	Halogen/fluorescent bulbs	Unit	74	0	74
4	Empty spray can (mosquito, colour, gas…)	Can	73	0	73
5	Used tire	Unit	0	0	0
6	Used battery	Unit	0	0	0
7	Oil water mixture	Litre	0	0	0
8	Contaminated soil/sand	Cubic Metre (m^3)	0	0	0
9	Clinic waste	kg	0.3	0	0.3

In addition, a total of 180 m3 of sewage sludge/black water from toilets of OSOV and ESD camp was transported and disposed of at the Spoil Disposal Area No. 6 by following the NNP1PC Standard Operating Procedure (SOP) on Sewage/Black Water Disposal.

NNP1PC is in the process of negotiating the contract with the local contractor who won the bid to undertake waste collection from the Project areas and disposal at NNP1 Project Landfill as well as waste collection from the host Villages and Phouhomxay Village and disposal at Houay Soup Landfill. It is expected that the contractor will be on board by February 2020. During this transition period, NNP1PC-EMO will continue to work with the villagers to deliver the wastes to the Houay Soup landfill on a weekly basis.

3.4 COMMUNITY WASTE MANAGEMENT

3.4.1 COMMUNITY RECYCLING PROGRAMME

In January 2020, the Community Waste Bank received 643 kg of recyclable waste (glass bottles) from the villagers of three host villages, making a new total of 2,751 kg of recyclable waste remaining in the Bank. An increase of 643 kg compared to December 2019.

TABLE 3-15: TYPES AND AMOUNTS OF RECYCLABLE WASTE TRADED AT THE COMMUNITY RECYCLE WASTE BANK

Types of Waste	Unit	Remaining in December 2019	Additional in January 2020	Sold	Remaining in January 2020
Scrap metal	kg	0	0	0	0
Glass bottles	kg	1149	643	0	1,792
Paper/cardboard	kg	923.5	0	0	923.5
Aluminium cans	kg	0	0	0	0
Plastic bottles	kg	35.5	0	0	35.5
Total	**kg**	**2,108**	**77.5**	**0**	**2,751**

3.4.2 COMMUNITY SOLID WASTE MANAGEMENT

A new Contractor is being recruited through an open bidding process to manage waste collection and landfill operation at NNP1 Project. It is expected that a contract will be signed in February 2020. Whist the new Contractor is being recruited, NNP1PC-EMO supported the villagers for transporting a total of 4 m3 of solid waste from the waste drop-off areas and schools at two host villages (Thaheur and Hat Gniun Villages) and Phouhomxay Village and disposed of at the Houay Soup landfill. The villagers were informed of an option to dispose their waste at the Houay Soup landfill by themselves by contacting EMO staff until the new Contractor is on board. WATERSHED AND BIODIVERSITY MANAGEMENT

3.5 WATERSHED AND BIODIVERSITY MANAGEMENT

3.5.1 WATERSHED MANAGEMENT

3.5.1.1 IMPLEMENTATION OF ANNUAL IMPLEMENTATION PLAN (AIP) 2019

NNP1PC processed a fund disbursement of USD 154,785 for both Bolikhamxay and Xaysomboun Provinces' approved AIPs.

The Department of Forestry (DOF), Ministry of Agriculture and Forestry (MAF) received a total of USD 112,034 from the Watershed Management Fund (WMF) under GOL's CA budget on 09 December 2019. DOF has transferred the funds to Bolikhamxay and Xaysomboun Provincial Watershed and Reservoir Protection Offices (WRPOs) on 20 December 2019.

NNP1PC processed the disbursement of USD 42,751 from NNP1PC additional No Net Loss (NNL) commitment which includes the procurement of office and field equipment totalling USD 19,494 to be processed by NNP1PC. Both WRPOs is expected to receive the funds and the equipment in February 2020.

Bolikhamxay Provincial WRPO continues with the preparation of Bolikhamxay Provincial Regulation for Watershed Management whilst the forest patrolling activity has started on 08 January 2020. Xaysomboun Provincial WRPO planned to commence the field verification of the Totally Protected Zones (TPZs) boundary in Anouvong and Hom Districts after receiving the NNL fund from DOF.

NNP1PC-EMO together with a consultant (FishBio) is preparing a Fishery Co-Management Plan. After a series of internal reviews and discussions by NNP1PC-EMO, the draft Plan was discussed with the Consultant on 24 January 2020. The improved draft is expected to be submitted in the first week of February 2020.

NNP1PC-EMO together with a consultant (Elixir) is conducting an assessment of options for sustainable livelihood opportunities focussing on nine watershed villages in Xaysomboun Province. The Consultant submitted a draft inception report on 06 January 2020 and discussed with NNP1PC-EMO team on 24 January 2020. The improved report was submitted by the Consultant on 30 January 2020 and the field assessment and data collection is scheduled to be undertaken during 17-24 February 2020.

3.5.2 BIODIVERSITY OFFSET MANAGEMENT

3.5.2.1 APPROVAL OF BIODIVERSITY SERVICE PROVIDER (BSP)

A draft Memorandum of Understanding (MOU) to be signed between NNP1PC-ADB-WCS was prepared by the NNP1PC lawyer and circulated with ADB and WCS on 20 January 2020 for their feedback.

NNP1PC was informed that the Minister of Ministry of Planning and Investment (MPI) provided a no objection for the proposed ADB Technical Assistance Project on Biodiversity Management on 15 January 2020.

3.5.2.2 IMPLEMENTATION OF BOMP ANNUAL IMPLEMENTATION PLAN (AIP) 2019

Progresses on the implementation of activities by Component are described below:

a. Component 1 - Spatial Planning and Regulation

Bolikhamxay Provincial BOMU procured 60 small signs (40x40 cm), 50 concrete poles and six big signs (2x3 m) as part of standard GOL's method to inform villagers on the agreed NC-NX Total Protected Zone (TPZ). The installation is rescheduled to start from beginning of February 2020.

b. Component 2 – Law Enforcement

Four patrolling teams continued with patrolling activities during 10-30 January 2020 by focusing on the highest TPZ priority area, Nam Hung TPZ high priority area, Nam Ma TPZ high priority area, as well as Nam Ka Gni and Nam Chamhung area in Xaychamphone District. A monthly meeting will be carried out in the first week of February 2020 where the results of patrolling in January 2020 will be presented and discussed.

c. Component 4 – Conservation linked livelihood development

NNP1PC-EMO together with a Panel of Experts is preparing a Community Development Plan (CDP) for the six NC-NX villages. The consultant submitted a draft Inception Report on 16 January 2020 and discussed with NNP1PC-EMO on 24 January 2020. The revised Inception Report was submitted on 31 January 2020 and the village consultation is scheduled to start in February 2020.

3.6 FLOATING DEBRIS REMOVAL

NNP1PC-EMO conducted a regular monitoring and removal of floating materials/logs from the temporary log-boom as needed. Permanent log booms are being stalled at the main dam and re-regulation dam reservoirs.

4. FISHERY MONITORING

Three species groups and two species dominated the fish catch by weight in December 2019 as listed in ***Table 4-1***. All species are classified as Least Concern (LC) according to the IUCN Red List of Threatened Species1, except Sikukia gudgeri is classified as Data Deficient (DD).

TABLE 4-1: FISH SPECIES DOMINATING THE FISH CATCH IN DECEMBER 2019

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
Poropuntius normani, Poropuntius laoensis,Poropuntius carinatus	ปาจาด	154.2	LC
Hampala dispar, Hampala macrolepidota	ปาสูด	133.8	LC
Oreochromis niloticus	ปานิม	104.3	LC
Channa striata	ปาถ่ำ	88	LC
Sikukia gudgeri, Amblyrhynchichthys truncatus	ปาขาอขาย	79.2	DD, LC

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

TABLE 4-2: THREATENED SPECIES OF DECEMBER 2019 FISH CATCH

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
Cirrhinus molitorella	ปาแกง	1	NT
Neolissochilus stracheyi	ปาสอง	0.7	NT
Onychostoma gerlachi	ปาถิง	17.9	NT
Scaphognathops bandanensis	ปาอวมไฟ/ปาป่วม	6.4	VU
Tor sinensis	ปาแดง	52.4	VU
Wallago attu	ปาถ้าอ	0.3	NT

[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.

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 December 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 - DECEMBER 2019

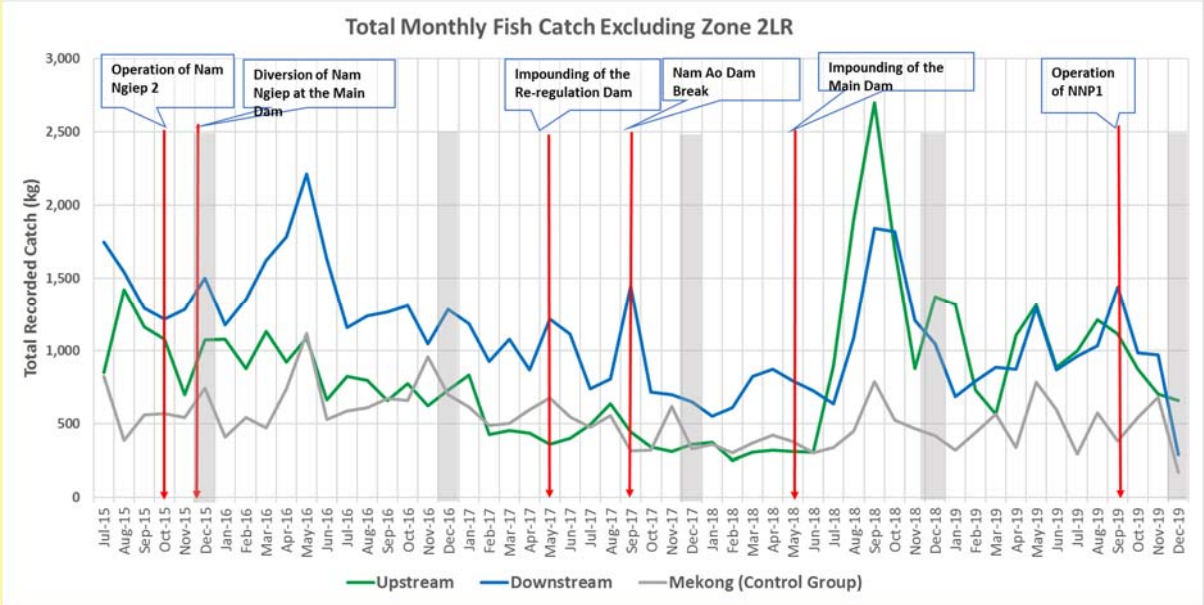
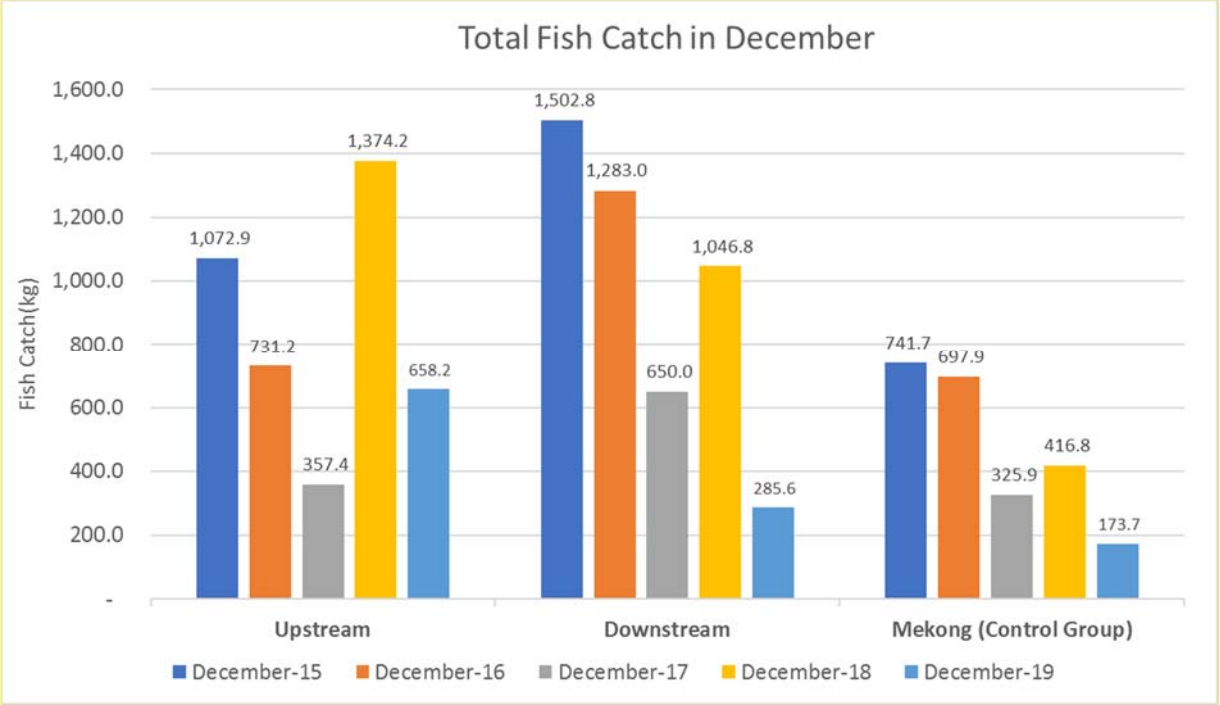


Table 4-3 and Figure 4-2 show a total recorded fish catch for December 2015, December 2016, December 2017, December 2018 and December 2019 in the upstream (excluding Zone 2LR) and downstream communities and the Mekong control group. The total fish catch data represents the total fish supply provided by the involved fishing households.

TABLE 4-3: TOTAL FISH CATCH BY UPSTREAM (EXCLUDING ZONE 2LR), DOWNSTREAM AND MEKONG CONTROL GROUP FISHING HOUSEHOLDS IN DECEMBER 2015, DECEMBER 2016, DECEMBER 2017, DECEMBER 2018 AND DECEMBER 2019

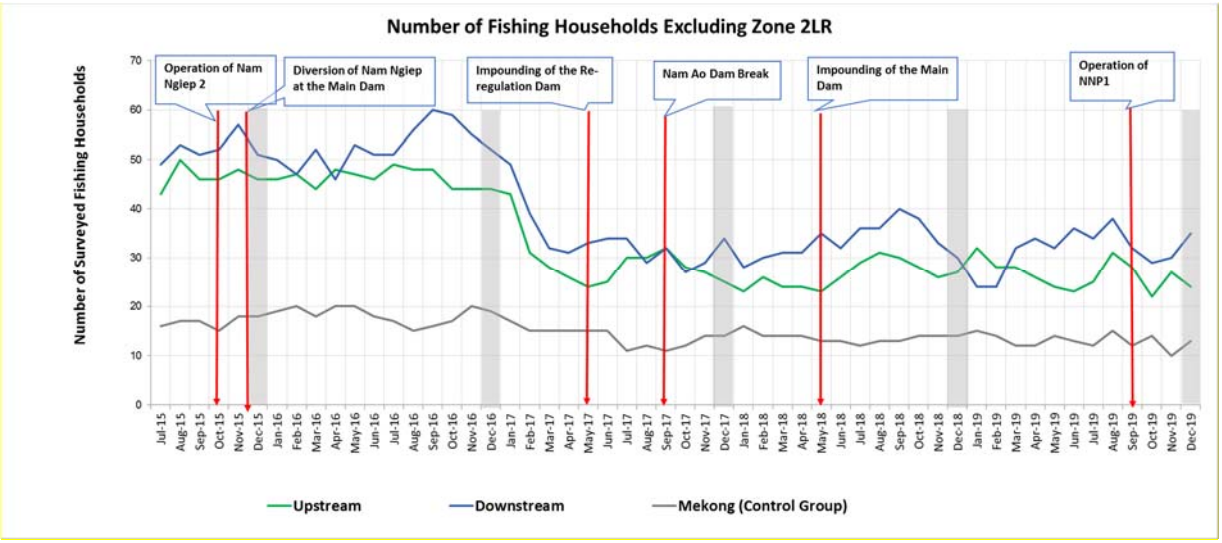
Fishing Zone	December 2015 (kg)	December 2016 (kg)	December 2017 (kg)	December 2018 (kg)	December 2019 (kg)
Upstream	1,072.9	731.2	357.4	1,374.2	658.2
Downstream	1,502.8	1,283.0	650.0	1,046.8	285.6
Mekong Control Group	741.7	697.9	325.9	416.8	173.7

FIGURE 4-2: TOTAL FISH CATCH BY UPSTREAM (EXCLUDING ZONE 2LR), DOWNSTREAM AND MEKONG CONTROL GROUP FISHING HOUSEHOLDS IN DECEMBER 2015, DECEMBER 2016, DECEMBER 2017, DECEMBER 2018 AND DECEMBER 2019



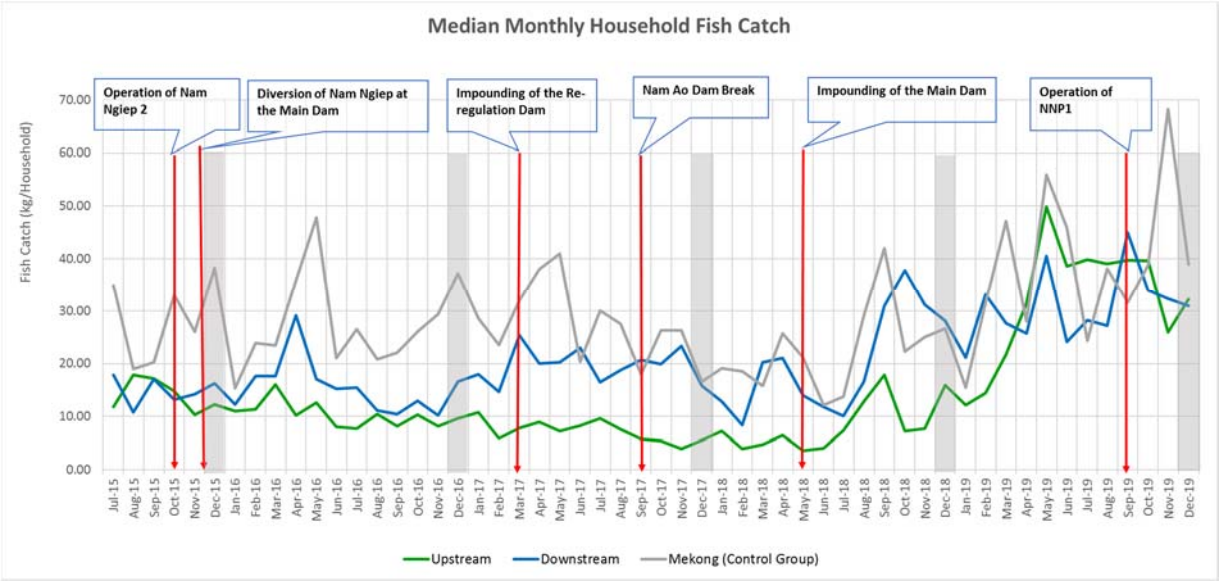
The numbers of fishing households involved in the fish catch monitoring programme are displayed in ***Figure 4-3***.

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



The median monthly household fish catch from July 2015 to December 2019 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 December 2015, December 2016, December 2017, December 2018 and December 2019 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	December 2015 (kg)	December 2016 (kg)	December 2017 (kg)	December 2018 (kg)	December 2019 (kg)
Upstream	12.3	9.7	5.5	15.9	32.3
Downstream	16.3	16.7	15.8	28.1	31.0
Mekong Control Group	38.3	37.2	16.6	26.6	39.0

The median daily fish catch per household are displayed in *Error! Reference source not found.*, and the median fish catch per household per fishing day in December 2015, December 2016, December 2017, December 2018 and December 2019 are shown in Table below;

FIGURE 4-5: MEDIAN DAILY FISH CATCH PER HOUSEHOLD

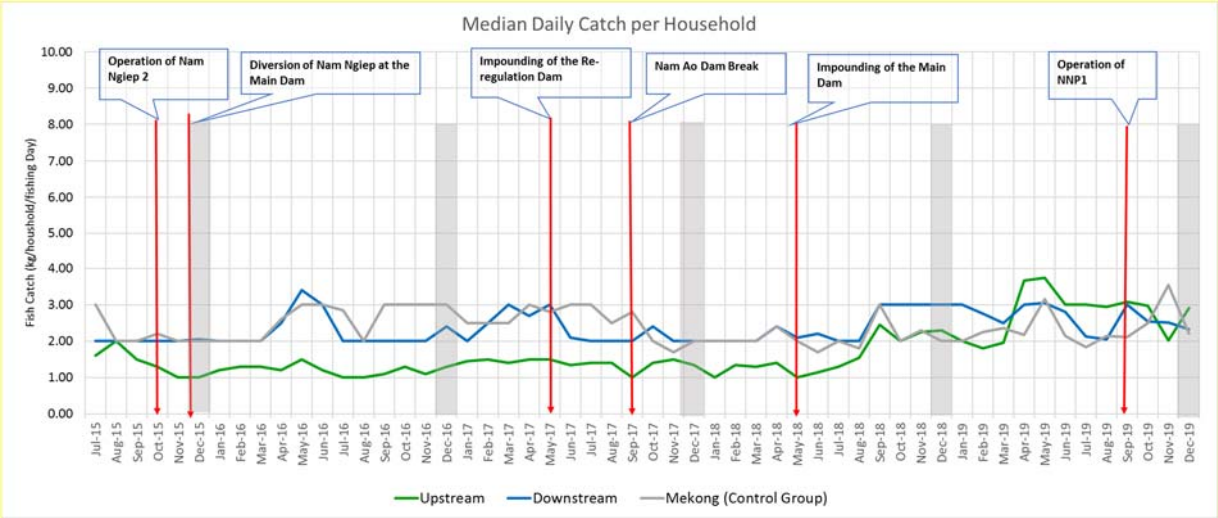


TABLE 4-5: MEDIAN DAILY FISH CATCH PER HOUSEHOLD IN DECEMBER 2019

Fishing Zone	December 2015 (kg)	December 2016 (kg)	December 2017 (kg)	December 2018 (kg)	December 2019 (kg)
Upstream	1.00	1.30	1.35	2.30	2.91
Downstream	2.05	2.40	2.00	3.00	2.33
Mekong (Control Group)	2.00	3.00	2.00	2.00	2.20

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						Re-regulation Reservoir		Downstream			
		Station Code	NNG 01	R1	R2	R3	R4	R5	R6	R7	NNG 05	NNG 06	NNG 07	NNG 08
Date	Parameters (Unit)	Guideline												
3-Jan-20	pH	5.0 - 9.0						6.55	7.03	7.21	7.29	6.18	6.9	6.33
7-Jan-20	pH	5.0 - 9.0		7.72	7.86	7.72	7.21							
8-Jan-20	pH	5.0 - 9.0						7.1	7.01	6.96	7.02	6.92	7.29	7.15
13-Jan-20	pH	5.0 - 9.0	6.42											
14-Jan-20	pH	5.0 - 9.0		6.72	7.25	7.76								
15-Jan-20	pH	5.0 - 9.0					7.21	7.37						
16-Jan-20	pH	5.0 - 9.0							6.27	6.22	6.49	6.97	6.82	7.04
21-Jan-20	pH	5.0 - 9.0		7.71	7.58	7.85	7.09							
22-Jan-20	pH	5.0 - 9.0						7.66	7.16	6.68	7.07	7.53	7.59	7.74
23-Jan-20	pH	5.0 - 9.0						7.39	7.25	7.12	7.22	7.5	7.54	7.7
27-Jan-20	pH	5.0 - 9.0	7.42											
28-Jan-20	pH	5.0 - 9.0						6.8	7.17	7	7.23	7.51	7.8	7.92
29-Jan-20	pH	5.0 - 9.0		7.61	7.55	7.49	7.24							
30-Jan-20	pH	5.0 - 9.0						6.74	6.81	6.93	7.32	7.55	7.63	7.76
3-Jan-20	Sat. DO (%)							86.4	50.1	29	50.5	45	69.9	78.1
7-Jan-20	Sat. DO (%)			110.8	101.3	103.4	100.5							
8-Jan-20	Sat. DO (%)							109.3	40.5	32.5	46.8	45	65.4	69.3
13-Jan-20	Sat. DO (%)		107.9											
14-Jan-20	Sat. DO (%)			103.5	86.7	92.6								
15-Jan-20	Sat. DO (%)						100.5	89.9						
16-Jan-20	Sat. DO (%)								47.1	36.7	71.02	73.4	71.6	74
21-Jan-20	Sat. DO (%)			79.8	78	77.9	85.8							
22-Jan-20	Sat. DO (%)							85.3	33	30.8	38.1	37.6	56	63.1
23-Jan-20	Sat. DO (%)							24.72	23.9	24.03	42.2	45.2	55.4	62.9
27-Jan-20	Sat. DO (%)		105.2											
28-Jan-20	Sat. DO (%)							22.5	37.4	39.7	59.4	56.4	66.2	72.6
29-Jan-20	Sat. DO (%)			86	48.8	65.5	58.4							
30-Jan-20	Sat. DO (%)							16.6	30.2	31.2	53.3	51.3	62.7	74.5
3-Jan-20	DO (mg/L)	>6.0						7.24	4.23	2.46	4.18	3.62	5.57	6.23
7-Jan-20	DO (mg/L)	>6.0		8.63	8.25	8.52	8.32							
8-Jan-20	DO (mg/L)	>6.0						9.07	3.42	2.79	3.97	3.63	5	5.53
13-Jan-20	DO (mg/L)	>6.0	8.54											

		River Name	Nam Ngiep											
		Zone	Location Refer to Construction Sites											
			Upstream/Main Reservoir						Re-regulation Reservoir		Downstream			
		Station Code	NNG 01	R1	R2	R3	R4	R5	R6	R7	NNG 05	NNG 06	NNG 07	NNG 08
Date	Parameters (Unit)	Guideline												
14-Jan-20	DO (mg/L)	>6.0		8.41	6.98	7.35								
15-Jan-20	DO (mg/L)	>6.0					8.32	7.39						
16-Jan-20	DO (mg/L)	>6.0							4.04	3.3	6.09	6.21	6.04	6.29
21-Jan-20	DO (mg/L)	>6.0		6.32	6.26	6.4	7.1							
22-Jan-20	DO (mg/L)	>6.0						7.1	2.78	2.58	3.18	3.14	4.63	5.16
23-Jan-20	DO (mg/L)	>6.0						6.76	3.32	3.1	3.51	3.77	4.61	5.18
27-Jan-20	DO (mg/L)	>6.0	8.63											
28-Jan-20	DO (mg/L)	>6.0						1.91	3.16	3.34	5.01	4.83	5.65	6.11
29-Jan-20	DO (mg/L)	>6.0		7.01	4.02	5.44	4.87							
30-Jan-20	DO (mg/L)	>6.0						1.4	2.56	2.6	4.49	4.35	5.23	6.22
3-Jan-20	Conductivity (µs/cm)							78	96	89	88	62.9	63.5	60.4
7-Jan-20	Conductivity (µs/cm)			94	92	82	77							
8-Jan-20	Conductivity (µs/cm)							78	100	90	89	62.2	83.6	61.6
13-Jan-20	Conductivity (µs/cm)		135.6											
14-Jan-20	Conductivity (µs/cm)			93	92	80								
15-Jan-20	Conductivity (µs/cm)						77	77						
16-Jan-20	Conductivity (µs/cm)								100	95	89	90	90	88
21-Jan-20	Conductivity (µs/cm)			93	92	80	78							
22-Jan-20	Conductivity (µs/cm)							77	100	97	95	93	90	88
23-Jan-20	Conductivity (µs/cm)							78	100	96	95	94	91	88
27-Jan-20	Conductivity (µs/cm)		83.6											
28-Jan-20	Conductivity (µs/cm)							81	96	94	91	91	90	89
29-Jan-20	Conductivity (µs/cm)			96	92	79	78							
30-Jan-20	Conductivity (µs/cm)							78	94	89	86	87	87	85
3-Jan-20	Temperature (°C)							24.41	23.96	23.96	24.65	24.54	26	25.9
7-Jan-20	Temperature (°C)			27.87	25.89	25.09	24.9							
8-Jan-20	Temperature (°C)							24.68	23.85	23.78	24.32	25	27.12	25.7
13-Jan-20	Temperature (°C)		25											
14-Jan-20	Temperature (°C)			25.75	26.33	26.66								
15-Jan-20	Temperature (°C)						24.9	24.94						

		River Name	Nam Ngiep											
		Zone	Location Refer to Construction Sites											
			Upstream/Main Reservoir						Re-regulation Reservoir		Downstream			
		Station Code	NNG 01	R1	R2	R3	R4	R5	R6	R7	NNG 05	NNG 06	NNG 07	NNG 08
Date	Parameters (Unit)	Guideline												
16-Jan-20	Temperature (°C)								23.76	23.53	24.15	24.08	24.66	25.23
21-Jan-20	Temperature (°C)			27.4	26.74	25.31	25.01							
22-Jan-20	Temperature (°C)							24.66	23.87	24.77	24.55	24.4	25.06	25.58
23-Jan-20	Temperature (°C)							24.72	23.9	24.03	24.62	24.45	24.79	25.2
27-Jan-20	Temperature (°C)		23											
28-Jan-20	Temperature (°C)							24.15	23.89	24.44	23.92	23.82	23.77	24.14
29-Jan-20	Temperature (°C)			25.89	25.27	24.82	24.51							
30-Jan-20	Temperature (°C)							24.06	23.64	24.62	24.04	23.74	24.48	24.24
3-Jan-20	Turbidity (NTU)							2.05	3.74	6.43	7.14	5.16	4.33	1.53
7-Jan-20	Turbidity (NTU)			5.1	2.3	2.26	2.03							
8-Jan-20	Turbidity (NTU)							2.26	4.41	7.7	9.58	11.77	7.35	7.23
13-Jan-20	Turbidity (NTU)		4.53											
14-Jan-20	Turbidity (NTU)			2.83	1.51	1.56								
15-Jan-20	Turbidity (NTU)						2.03	1.11						
16-Jan-20	Turbidity (NTU)								8.11	5.02	7.16	6.96	5.97	6.17
21-Jan-20	Turbidity (NTU)			4.91	2.23	2.23	2.18							
22-Jan-20	Turbidity (NTU)							2.18	3.75	3.27	5.51	8.47	6.9	7.02
23-Jan-20	Turbidity (NTU)							2.65	3.11	4.52	6.52	8.46	8.67	8.86
27-Jan-20	Turbidity (NTU)		2.74											
28-Jan-20	Turbidity (NTU)							2.48	2.81	4.18	8.88	8	9.64	7.3
29-Jan-20	Turbidity (NTU)			5.17	2.48	2.32	2.42							
30-Jan-20	Turbidity (NTU)							2.27	3.98	8.26	8.28	9.2	10.22	9.06
13-Jan-20	TSS (mg/L)		<5											
14-Jan-20	TSS (mg/L)			5.86	<5	<5								
15-Jan-20	TSS (mg/L)						<5	<5						
16-Jan-20	TSS (mg/L)								28.53	8.13	6.04	10	<5	11.2
13-Jan-20	BOD_5 (mg/L)	<1.5	<1.0											
14-Jan-20	BOD_5 (mg/L)	<1.5		1.29		1.91								
15-Jan-20	BOD_5 (mg/L)	<1.5					<1.0	<1.0						
16-Jan-20	BOD_5 (mg/L)	<1.5							6.36	5.26	1.17	2.63	3.35	1.04
13-Jan-20	COD (mg/L)	<5.0	7.9											
14-Jan-20	COD (mg/L)	<5.0												
16-Jan-20	COD (mg/L)	<5.0							9.1	6.2	8.3	7.5	5.6	6.3
13-Jan-20	NH_3-N (mg/L)	<0.2	<0.2											
14-Jan-20	NH_3-N (mg/L)	<0.2		<0.2		<0.2	<0.2							

		River Name	Nam Ngiep											
		Zone	Location Refer to Construction Sites											
			Upstream/Main Reservoir						Re-regulation Reservoir		Downstream			
		Station Code	NNG 01	R1	R2	R3	R4	R5	R6	R7	NNG 05	NNG 06	NNG 07	NNG 08
Date	Parameters (Unit)	Guideline												
15-Jan-20	NH_3-N (mg/L)	<0.2						<0.2						
13-Jan-20	NO_3-N (mg/L)	<5.0	<0.02											
14-Jan-20	NO_3-N (mg/L)	<5.0		<0.02		<0.02	<0.02							
15-Jan-20	NO_3-N (mg/L)	<5.0						<0.02						
13-Jan-20	Faecal coliform (MPN/100 ml)	<1,000	79											
14-Jan-20	Faecal coliform (MPN/100 ml)	<1,000		2		0								
15-Jan-20	Faecal coliform (MPN/100 ml)	<1,000					2	0						
16-Jan-20	Faecal coliform (MPN/100 ml)	<1,000							0	0	5	2	17	33
13-Jan-20	Total Coliform (MPN/100 ml)	<5,000	170											
14-Jan-20	Total Coliform (MPN/100 ml)	<5,000		1,600		350								
15-Jan-20	Total Coliform (MPN/100 ml)	<5,000					240	27						
16-Jan-20	Total Coliform (MPN/100 ml)	<5,000							130	27	220	350	540	920
13-Jan-20	TKN		<1.5											
14-Jan-20	TKN			<1.5		<1.5								
15-Jan-20	TKN						<1.5	<1.5						
16-Jan-20	TKN													
13-Jan-20	TOC (mg/L)		1.02											
14-Jan-20	TOC (mg/L)					2.65								
15-Jan-20	TOC (mg/L)						1.6	1.72						
16-Jan-20	TOC (mg/L)								1.99	1.83	1.65	1.95	1.78	1.69
14-Jan-20	Phytoplankton Biomass (g dry wt/m^3)			5		2								
15-Jan-20	Phytoplankton Biomass (g dry wt/m^3)						0.8	0.8						
16-Jan-20	Phytoplankton Biomass (g dry wt/m^3)													
13-Jan-20	Total Phosphorus (mg/L)		0.03											
14-Jan-20	Total Phosphorus (mg/L)			<0.01		<0.01								
15-Jan-20	Total Phosphorus (mg/L)						<0.01	<0.01						

		River Name	Nam Ngiep											
		Zone	Location Refer to Construction Sites											
			Upstream/Main Reservoir						Re-regulation Reservoir		Downstream			
		Station Code	NNG 01	R1	R2	R3	R4	R5	R6	R7	NNG 05	NNG 06	NNG 07	NNG 08
Date	Parameters (Unit)	Guideline												
16-Jan-20	Total Phosphorus (mg/L)													
13-Jan-20	Total Dissolved Phosphorus (mg/L)		0.02											
14-Jan-20	Total Dissolved Phosphorus (mg/L)			<0.01		<0.01								
15-Jan-20	Total Dissolved Phosphorus (mg/L)						<0.01	<0.01						
16-Jan-20	Total Dissolved Phosphorus (mg/L)													
14-Jan-20	Hydrogen Sulfide (mg/L)			<0.02		<0.02								
15-Jan-20	Hydrogen Sulfide (mg/L)						<0.02	<0.02						

TABLE A-2: ***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				
3-Jan-20	pH	5.0 - 9.0			6.28	6.65
7-Jan-20	pH	5.0 - 9.0		7.92		
8-Jan-20	pH	5.0 - 9.0			7.21	6.19
13-Jan-20	pH	5.0 - 9.0	6.45			
14-Jan-20	pH	5.0 - 9.0		7.05		
16-Jan-20	pH	5.0 - 9.0			6.6	6.94
21-Jan-20	pH	5.0 - 9.0		7.73		
22-Jan-20	pH	5.0 - 9.0			7.41	7.61
23-Jan-20	pH	5.0 - 9.0			7.54	7.32
27-Jan-20	pH	5.0 - 9.0	7.82			
28-Jan-20	pH	5.0 - 9.0			7.74	7.18
29-Jan-20	pH	5.0 - 9.0		7.68		
30-Jan-20	pH	5.0 - 9.0			7.5	7.78
3-Jan-20	Sat. DO (%)				97.1	74.4
7-Jan-20	Sat. DO (%)			104.2		
8-Jan-20	Sat. DO (%)				74.8	67.9
13-Jan-20	Sat. DO (%)		102.6			
14-Jan-20	Sat. DO (%)			77		
16-Jan-20	Sat. DO (%)				76.8	74.3
21-Jan-20	Sat. DO (%)			88.7		
22-Jan-20	Sat. DO (%)				77.2	73.6
23-Jan-20	Sat. DO (%)				74.5	78
27-Jan-20	Sat. DO (%)		98.6			
28-Jan-20	Sat. DO (%)				75.2	71.1
29-Jan-20	Sat. DO (%)			86.9		
30-Jan-20	Sat. DO (%)				80.9	74.6
3-Jan-20	DO (mg/L)	>6.0			7.61	6.2
7-Jan-20	DO (mg/L)	>6.0		9.32		
8-Jan-20	DO (mg/L)	>6.0			6.23	5.62
13-Jan-20	DO (mg/L)	>6.0	8.15			
14-Jan-20	DO (mg/L)	>6.0		6.68		

		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				
16-Jan-20	DO (mg/L)	>6.0			6.53	6.31
21-Jan-20	DO (mg/L)	>6.0		7.36		
22-Jan-20	DO (mg/L)	>6.0			6.14	6.03
23-Jan-20	DO (mg/L)	>6.0			6.17	6.46
27-Jan-20	DO (mg/L)	>6.0	8.27			
28-Jan-20	DO (mg/L)	>6.0			6.23	6.1
29-Jan-20	DO (mg/L)	>6.0		7.79		
30-Jan-20	DO (mg/L)	>6.0			6.84	6.12
3-Jan-20	Conductivity (µs/cm)				109.9	62.3
7-Jan-20	Conductivity (µs/cm)			83		
8-Jan-20	Conductivity (µs/cm)				84.4	49.9
13-Jan-20	Conductivity (µs/cm)		141.9			
14-Jan-20	Conductivity (µs/cm)			81		
16-Jan-20	Conductivity (µs/cm)				116	94
21-Jan-20	Conductivity (µs/cm)			83		
22-Jan-20	Conductivity (µs/cm)				121	80
23-Jan-20	Conductivity (µs/cm)				151	80
27-Jan-20	Conductivity (µs/cm)		26.2			
28-Jan-20	Conductivity (µs/cm)				116	69
29-Jan-20	Conductivity (µs/cm)			81		
30-Jan-20	Conductivity (µs/cm)				116	99
3-Jan-20	Temperature (°C)				26.9	25.4
7-Jan-20	Temperature (°C)			21.2		
8-Jan-20	Temperature (°C)				27	25.3
13-Jan-20	Temperature (°C)		24.5			
14-Jan-20	Temperature (°C)			22.41		
16-Jan-20	Temperature (°C)				23.82	23.77
21-Jan-20	Temperature (°C)			21.43		
22-Jan-20	Temperature (°C)				26.31	25.45
23-Jan-20	Temperature (°C)				24.84	24.6
27-Jan-20	Temperature (°C)		21.7			
28-Jan-20	Temperature (°C)				23.89	23.58
29-Jan-20	Temperature (°C)			20.5		
30-Jan-20	Temperature (°C)				23.77	23.22
3-Jan-20	Turbidity (NTU)				3.64	3.96

		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				
7-Jan-20	Turbidity (NTU)			11.43		
8-Jan-20	Turbidity (NTU)				7.13	6.52
13-Jan-20	Turbidity (NTU)		2.6			
14-Jan-20	Turbidity (NTU)			5.56		
16-Jan-20	Turbidity (NTU)				6.99	5.34
21-Jan-20	Turbidity (NTU)			5.83		
22-Jan-20	Turbidity (NTU)				5.67	5.8
23-Jan-20	Turbidity (NTU)				6.86	5.98
27-Jan-20	Turbidity (NTU)		1.65			
28-Jan-20	Turbidity (NTU)				6.65	6.31
29-Jan-20	Turbidity (NTU)			4.99		
30-Jan-20	Turbidity (NTU)				7.16	6.1
13-Jan-20	TSS (mg/L)		<5			
14-Jan-20	TSS (mg/L)			34.08		
16-Jan-20	TSS (mg/L)				7.15	<5
13-Jan-20	BOD_5 (mg/L)	<1.5	<1.0			
14-Jan-20	BOD_5 (mg/L)	<1.5		<1.0		
15-Jan-20	BOD_5 (mg/L)	<1.5				
16-Jan-20	BOD_5 (mg/L)	<1.5			1.84	2.03
13-Jan-20	COD (mg/L)	<5.0	<5.0			
14-Jan-20	COD (mg/L)	<5.0		9.1		
16-Jan-20	COD (mg/L)	<5.0			5.6	5.2
14-Jan-20	NH_3-N (mg/L)	<0.2		<0.2		
14-Jan-20	NO_3-N (mg/L)	<5.0		<0.02		
13-Jan-20	Faecal coliform (MPN/100 ml)	<1,000	11			
14-Jan-20	Faecal coliform (MPN/100 ml)	<1,000		14		
16-Jan-20	Faecal coliform (MPN/100 ml)	<1,000			14	23
13-Jan-20	Total Coliform (MPN/100 ml)	<5,000	240			
14-Jan-20	Total Coliform (MPN/100 ml)	<5,000		130		
16-Jan-20	Total Coliform (MPN/100 ml)	<5,000			920	1,600

		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				
13-Jan-20	TKN		<1.5			
14-Jan-20	TKN			<1.5		
13-Jan-20	TOC (mg/L)		0.72			
14-Jan-20	TOC (mg/L)			1.36		
16-Jan-20	TOC (mg/L)				2.05	2.88
13-Jan-20	Total Phosphorus (mg/L)		<0.01			
14-Jan-20	Total Phosphorus (mg/L)			0.05		
13-Jan-20	Total Dissolved Phosphorus (mg/L)		<0.01			
14-Jan-20	Total Dissolved Phosphorus (mg/L)			0.05		

ANNEX B: RESULTS OF EFFLUENT ANALYSES

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

	Site Name	Owner's Site Office and Village		ESD Camp No.2 (HM Main Camp)		ESD Camp		Main Powerhouse		SongDa5 Camp No.1	
	Station Code	EF01		EF13		EF14		EF19		EF07	
	Date	06-Jan-20	20-Jan-20	06-Jan-20	20-Jan-20	06-Jan-20	20-Jan-20	06-Jan-20	20-Jan-20	06-Jan-20	20-Jan-20
Parameters (Unit)	**Guideline**										
pH	6.0 - 9.0	7.09	7.06	6.57	7.15	6.81	7.4		6.88	No discharge. This camp is under decommissioning.	
Sat. DO (%)		61.3	75	28.6	49.9	22.3	31		39.7		
DO (mg/L)		4.74	5.92	2.25	3.93	1.64	2.44		3.05		
Conductivity (µs/cm)		351	336	352	464	433	348		991		
TDS (mg/L)		175.5	168	176	232	216.5	174		495.5		
Temperature (°C)		27	25.9	25.9	26.1	30	26.3		27.6		
Turbidity (NTU)		0.98	1.07	5.87	14.25	8.91	16		11.29		
TSS (mg/L)	<50	<5	<5	<5	6.7	<5	7.8		34.0		
BOD5 (mg/L)	<30	<6	<6	<6	<6	<6	<6		<6		
COD (mg/L)	<125	<25	<25	<25	36.4	68	50.8		102		
NH3-N (mg/L)	<10.0	2	<1.5	6.5	19.6	7.5	15.1		56.7		
Total Nitrogen (mg/L)	<10.0	0.89	15.6	11	20.3	12.9	21		154		
Total Phosphorus (mg/L)	<2	1.37	1.54	0.69	1.67	0.76	1.36		2.92		
Oil & Grease (mg/L)	<10.0	<1		<1		<1					
Total coliform (MPN/100 ml)	<400	79	140	0	0	0	0		33		
Faecal Coliform (MPN/100 ml)	<400	13	7	0	0	0	0		33		
Effluent Discharge Volume (L/mn)		6	7		4		3				
Chlorination Dosing Rate (ml/mn)		n/a	n/a		24		20		435		
Residual Chlorine (mg/L)	<1.0	n/a	n/a	1.0	0.5	0.81	0.34		0.76		

TABLE B-2: *RESULTS OF THE CONSTRUCTION AREA DISCHARGE IN JANUARY 2020*

	Site Name	Upstream Spoil Disposal Area No.2			
	Station Code	DS04 - US			
	Date	09-Jan-20	16-Jan-20	31-Jan-20	
Parameter (Unit)	Guideline				
pH	6.0 - 9.0	6.7	5.87	6.12	
Sat. DO (%)		76.5	69.4	53.4	
DO (mg/L)		5.94	6.16	4.28	
Conductivity (µs/cm)		11.36	19	9.24	
TDS (mg/L)		5.68	9.5	4.62	
Temperature (°C)		26.5	23.13	25.9	
Turbidity (NTU)		4.97	3.53	4.71	
TSS (mg/L)	<50		5.4		

	Site Name	Spoil Disposal Area No.2			
	Station Code	DS04 - US			
	Date	09-Jan-20	16-Jan-20	31-Jan-20	
Parameter (Unit)	Guideline				
pH	6.0 - 9.0	6.38	5.6	6.32	
Sat. DO (%)		35.8	63.7	43.9	
DO (mg/L)		2.73	5.32	3.52	
Conductivity (µs/cm)		50.1	63	56.7	
TDS (mg/L)		25.05	31.5	28.35	
Temperature (°C)		27.6	24.88	25.3	
Turbidity (NTU)		3.36	1.83	3.92	
TSS (mg/L)	<50		2		