



**NAM NGIEP 1**  
POWER COMPANY

## Nam Ngiep 1 Hydropower Project

# Environmental Management Monthly Monitoring Report

July 2020

A	15 August 2020	Hendra WINASTU Khamtone SAYSONPHOU	Wanidaporn RODE	Khamlar PHONSAVAT	Final
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## TABLE OF CONTENTS

<b>EXECUTIVE SUMMARY.....</b>	<b>9</b>
<b>1. INTRODUCTION .....</b>	<b>11</b>
<b>2. WORK PROGRESS OF PRINCIPAL CONTRACTORS .....</b>	<b>11</b>
2.1 OPERATION AND POWER GENERATION .....	12
2.1.1 <i>Power Production .....</i>	<i>12</i>
2.1.2 <i>Outage, Liquidated Damages and Unavailability.....</i>	<i>17</i>
2.2 MAINTENANCE WORK.....	18
2.3 CIVIL AND APPURTENANT STRUCTURE .....	18
2.3.1 <i>Reservoir .....</i>	<i>18</i>
2.3.2 <i>Dam and Power Plant.....</i>	<i>19</i>
2.4 TRANSMISSION SYSTEM .....	21
2.4.1 <i>Tower No.1 of 230 kV TL Replacement and Dismantling .....</i>	<i>21</i>
<b>3. ENVIRONMENTAL MANAGEMENT MONITORING .....</b>	<b>24</b>
3.1 COMPLIANCE MANAGEMENT.....	24
3.1.1 <i>Site Inspection by Environment Management Unit.....</i>	<i>25</i>
3.1.2 <i>Site Decommissioning and Rehabilitation .....</i>	<i>25</i>
3.2 ENVIRONMENTAL QUALITY MONITORING.....	26
3.2.1 <i>Effluent Discharge from Camps and Construction Sites .....</i>	<i>26</i>
3.2.2 <i>Ambient Surface Water Quality Monitoring.....</i>	<i>27</i>
3.2.3 <i>Groundwater Quality Monitoring.....</i>	<i>31</i>
3.2.4 <i>Gravity Fed Water Supply (GFWS) Quality Monitoring .....</i>	<i>32</i>
3.2.5 <i>Landfill Leachate Monitoring.....</i>	<i>32</i>
3.2.6 <i>Discharge Monitoring .....</i>	<i>33</i>
3.2.6.1 <i>Main Reservoir – Water Level, Inflow and Discharge.....</i>	<i>33</i>
3.2.6.2 <i>Re-regulation Reservoir – Discharge.....</i>	<i>34</i>
3.2.7 <i>Nam Ngiep Downstream Water Depth Monitoring .....</i>	<i>35</i>
3.3 PROJECT WASTE MANAGEMENT .....	35
3.3.1 <i>Solid Waste Management .....</i>	<i>35</i>
3.3.2 <i>Hazardous Materials and Waste Management .....</i>	<i>36</i>
3.4 COMMUNITY WASTE MANAGEMENT .....	37
3.4.1 <i>Community Recycling Programme .....</i>	<i>37</i>
3.4.2 <i>Community Solid Waste Management.....</i>	<i>37</i>
3.5 WATERSHED AND BIODIVERSITY MANAGEMENT .....	37

3.5.1 Watershed Management .....	37
3.5.2 Biodiversity Offset Management.....	38
3.6 FLOATING DEBRIS REMOVAL.....	43
<b>4. FISHERY MONITORING.....</b>	<b>43</b>
<b>ANNEX A: RESULTS OF WATER QUALITY MONITORING .....</b>	<b>49</b>
<b>ANNEX B: RESULTS OF EFFLUENT ANALYSES.....</b>	<b>57</b>

## TABLE OF TABLES

<i>Table 2-1: Summary of Main Dam in July 2020 .....</i>	<b>13</b>
<i>Table 2-2 : Summary of Main power station in July 2020 .....</i>	<b>13</b>
<i>Table 2-3 : Energy amount in July 2020 (Main Power Station) .....</i>	<b>13</b>
<i>Table 2-4 : Declaration (Main Power Station) .....</i>	<b>14</b>
<i>Table 2-5 : Summary of Re-regulation Dam in July 2020 .....</i>	<b>15</b>
<i>Table 2-6: Summary of Re-regulation Power Station in July 2020 .....</i>	<b>15</b>
<i>Table 2-7: Energy Amount in July 2020 (Re-regulation Power Station) .....</i>	<b>16</b>
<i>Table 2-8: Unavailability and Significant Event in July 2020 (Main Power Station) .....</i>	<b>17</b>
<i>Table 2-9: Liquidated Damage in July 2020 (Main Power Station).....</i>	<b>17</b>
<i>Table 2-10 : Unavailability and Significant Event in July 2020 (Re-regulation Power Station).....</i>	<b>17</b>
<i>Table 3-1: SS-ESMMP and Document Review Status in July 2020 .....</i>	<b>24</b>
<i>Table 3-2: Summary of ONCs and NCRs .....</i>	<b>24</b>
<i>Table 3-3: Status of Corrective Actions for Non-Compliances at Camps and Construction Sites .....</i>	<b>26</b>
<i>Table 3-4: Results of Surface Water Quality Monitoring for Dissolved Oxygen (mg/L) in the upper 0.2 m, Water Quality Standard: &gt;6.0 mg/L.....</i>	<b>30</b>
<i>Table 3-5: Results of Surface Water Quality Monitoring for Total Suspended Solids (mg/L) - Water Quality Standard: No Standard .....</i>	<b>31</b>
<i>Table 3-6: Results of Surface Water Quality Monitoring for BOD<sub>5</sub> (mg/L) - Water Quality Standard: &lt; 1.5 mg/L.....</i>	<b>31</b>
<i>Table 3-7: Groundwater Quality Monitoring Results in Somsuen, Nam Pa, ThongNoy and Pou Villages .....</i>	<b>31</b>
<i>Table 3-8: Results of the Gravity Fed Water Supply Quality Monitoring .....</i>	<b>32</b>
<i>Table 3-9: Results of the Landfill Leachate Monitoring .....</i>	<b>33</b>
<i>Table 3-10: Amounts of Recyclable Waste Sold .....</i>	<b>36</b>
<i>Table 3-11: Record of Hazardous Material Inventory.....</i>	<b>36</b>
<i>Table 3-12: Record of Hazardous Waste Inventory .....</i>	<b>36</b>

<b>Table 3-13: Types and Amounts of Recyclable Waste Traded at the Community Recycle Waste Bank .....</b>	<b>37</b>
<b>Table 4-1: Fish Species dominating the Fish Catch in June 2020 .....</b>	<b>43</b>
<b>Table 4-2: Threatened Species of June 2020 Fish Catch .....</b>	<b>44</b>
<b>Table 4-3: Total Fish Catch by Upstream (Excluding Zone 2LR), Downstream and Mekong Control Group Fishing Households for the month of June from 2016 to 2020 .....</b>	<b>45</b>
<b>Table 4-4: Median Monthly Household Fish Catch in the Upstream and Downstream Communities Excluding Zone 2LR for the month of June from 2016 to 2020 .....</b>	<b>46</b>
<b>Table 4-5: Median Daily Fish Catch per Household for the month of June from 2016 to 2020</b>	<b>47</b>

## TABLE OF FIGURES

<b>Figure 1-1: Location Map .....</b>	<b>11</b>
<b>Figure 2-1: Unit Generated Energy (Main Power Station) .....</b>	<b>12</b>
<b>Figure 2-2: Unit Operation Hours (Main Power Station) .....</b>	<b>12</b>
<b>Figure 2-3: Unit Generated Energy (Re-regulation Power Station) .....</b>	<b>14</b>
<b>Figure 2-4: Unit Operation Hours (Re-regulation Power Station) .....</b>	<b>15</b>
<b>Figure 2-5: Dam Reservoir Level.....</b>	<b>16</b>
<b>Figure 2-6: Spillway gate operation with EGAT –PPA team .....</b>	<b>18</b>
<b>Figure 2-7: Operation test of Gantry crane of intake gate of Main Dam.....</b>	<b>18</b>
<b>Figure 2-8: Reservoir of Main Dam.....</b>	<b>19</b>
<b>Figure 2-9:: Reservoir of Re-regulation Dam.....</b>	<b>19</b>
<b>Figure 2-10: Re-vegetation of RCC Plant Yard.....</b>	<b>19</b>
<b>Figure 2-11: Re-vegetation of CVC Plant Yard.....</b>	<b>19</b>
<b>Figure 2-12: Quarry Area View Showing Re-Vegetation and Safety Fence Installation .....</b>	<b>20</b>
<b>Figure 2-13: Phase 2 of Project Landfill Development on 08 June 2017 .....</b>	<b>20</b>
<b>Figure 2-14: Schedule of Significant Remaining Works in 2020 .....</b>	<b>21</b>
<b>Figure 2-15: Top view of Gantry structure _ Slope protection around foundation ongoing</b>	<b>22</b>
<b>Figure 2-16: 230 KV transmission line route from Main Power station to Nabong substation</b>	<b>22</b>
<b>Figure 2-17: cutting high trees under transmission Lines .....</b>	<b>23</b>
<b>Figure 2-18: Cleaning vines climbing on towers .....</b>	<b>23</b>
<b>Figure 2-19: Fixing and replacement of stolen parts (bolt _ nut) .....</b>	<b>23</b>
<b>Figure 2-20: Fixing and replacement of stolen part members.....</b>	<b>23</b>
<b>Figure 3-1: Additional Counter Measures for the Site Rehabilitation in July 2020 .....</b>	<b>25</b>
<b>Figure 3-2: Surface Water and Re-Regulation Reservoir Water Quality Monitoring Stations</b>	<b>29</b>

<b>Figure 3-3: Concentration of Dissolved Oxygen in the Upper 0.2 m since September 2019 to July 2020 .....</b>	<b>30</b>
<b>Figure 3-4: Water Level, Inflow and Discharge for the Main Reservoir .....</b>	<b>34</b>
<b>Figure 3-5: Discharge Monitoring at the Re-regulation Dam in June and July 2020 .....</b>	<b>35</b>
<b>Figure 3-6: Map of NC-NX post demarcation and TPZ signage installation .....</b>	<b>39</b>
<b>Figure 3-7: Map of Threats Recorded by Patrolling Teams in June 2020 .....</b>	<b>41</b>
<b>Figure 3-8: Map of Wildlife Signs Recorded by Patrolling Teams in June 2020 .....</b>	<b>41</b>
<b>Figure 3-9: Fishing camp observed by Team 1 at Nam Xi, Viengthong District.....</b>	<b>42</b>
<b>Figure 3-10: Fishing camp observed by Team 3 at Nam Chamhung .....</b>	<b>42</b>
<b>Figure 3-11: Small wire snare collected at Nam Houng by Team 3 .....</b>	<b>42</b>
<b>Figure 3-12: Carcass of Silver Pheasant at mountain ridge along Nam Sik because of the large wire snare .....</b>	<b>42</b>
<b>Figure 3-13: Hog Badger .....</b>	<b>42</b>
<b>Figure 3-14: Phayre's leaf monkey .....</b>	<b>42</b>
<b>Figure 4-1: Total Monthly Fish Catch July 2015 – June 2020 .....</b>	<b>44</b>
<b>Figure 4-2: Total Fish Catch by Upstream (Excluding Zone 2LR), Downstream and Mekong Control Group Fishing Households for the month of June from 2016 to 2020 .....</b>	<b>45</b>
<b>Figure 4-3: Number of Fishing Households Involved in the Fish Catch Monitoring Programme .....</b>	<b>46</b>
<b>Figure 4-4: Median Monthly Household Fish Catch without Zone 2LR .....</b>	<b>46</b>
<b>Figure 4-5: Median Daily Fish Catch per Household .....</b>	<b>47</b>

**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
ECOD	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
PPA	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 July 2020, the Environmental Management Office (EMO) of Nam Ngiep 1 Power Company (NNP1PC) received two Detail Work Programs (DWP) and Site Specific Environmental and Social Management and Monitoring Plans (SS-ESMMP) for review and approval.

At 03 sites (spoil disposal area no.8, V&K camp and the main quarry) out of 08 revegetated sites, where the green cover is less than 70%, the Civil Works Contractor planted additional local grass species. Appropriate counter measures will continue to be implemented on the remaining 05 sites (ZHEFU camp, Spoil No.2, RCC plant, CVC plant and Song Da5 magazine) to ensure the green cover of at least 70% by the end of wet season 2020.

For the pending revegetation work at the LILAMA10 camp with the issued NCR level 1, EMO requested NNP1-TD to further coordinate with the HM Hydro Contractor to find an alternative measure to complete the work by August 2020 to ensure successful revegetation during this wet season.

Due to the country's COVID-19 lockdown since mid-March 2020 until the end of May and continued to the end of July 2020, no water samples were shipped to UAE Laboratory in Thailand. The water samples were measured in-situ for dissolved oxygen, temperature, pH and conductivity, and additional 5 parameters (TSS, BOD5, Faecal Coliform, E. Coli Bacteria and Total Coliform) were analysed at NNP1 Project Environmental Laboratory.

The wastewater pipes in OSOV2 (ESD camp) were joined to transport all wastewater in the camp to be treated in one WWTS, therefore only 01 Effluent sampling site (EF13) remains in OSOV2 and EF14 sampling site has been cancelled commencing in July 2020.

The effluent monitoring results at 02 out of 03 camps still indicate non-compliances with the GoL standards for total coliform and faecal coliform. An external consultant contract was signed to assess the design and operation of the existing WWTSs. NNP1PC-EMO has provided all relevant information and the site visit will be carried out when the country's lockdown is lifted.

During the month, Dissolved Oxygen (DO) levels at the surface of the main reservoir (R1, R2, R3, R4 and R5) were generally between 6 and 8 mg/L. In the re-regulation reservoir (R6 and R7), the DO levels were below 4 mg/L.

The discharge from the re-regulation dam went through the turbines during the monitoring missions, similar to June 2020, and the DO levels were below 6 mg/L at Nam Ngiep downstream stations (except on 15 and 30 July 2020 at NNG08). However, same as the previous months with the same range of DO levels, no dead fish was observed during this monitoring period. NNP1PC is in the process of collecting information to assist in the design of additional aeration structures to improve the DO level downstream.

A total of 19.6 m<sup>3</sup> solid waste was disposed at the NNP1 Project Landfill, an increase of 0.2 m<sup>3</sup> compared to June 2020. No buying/selling activity in the Community Waste Bank, therefore a total of 3,137 kg recyclable remains the same as recorded in June 2020. A total of 15.3 m<sup>3</sup> solid waste from Phouhomxay, Thahuea and Hat Gniun Villages was disposed at the Houay Soup Landfill.

A working session on SMART for the patrol team of Xaysomboun Provincial WRPO was organized on 17 July 2020 and the reservoir patrolling was postponed to August 2020. There was no implementation activity by Bolikhamxay Provincial WRPO during this reporting period.

Biodiversity offset related activities under the components of law enforcement and conservation linked livelihood continued in July 2020.

The fish catch monitoring for June 2020 in Nam Ngiep watershed was dominated *Pangasius conchophilus* and *Tor sinensis* and species groups of *Hampala*, *Poropuntius* and *Barbonymus* and *Hypsibarbus* that are classified as Least Concern (LC) according to the IUCN Red List, except *Tor sinensis* is classified as Vulnerable (VU).

## 1. INTRODUCTION

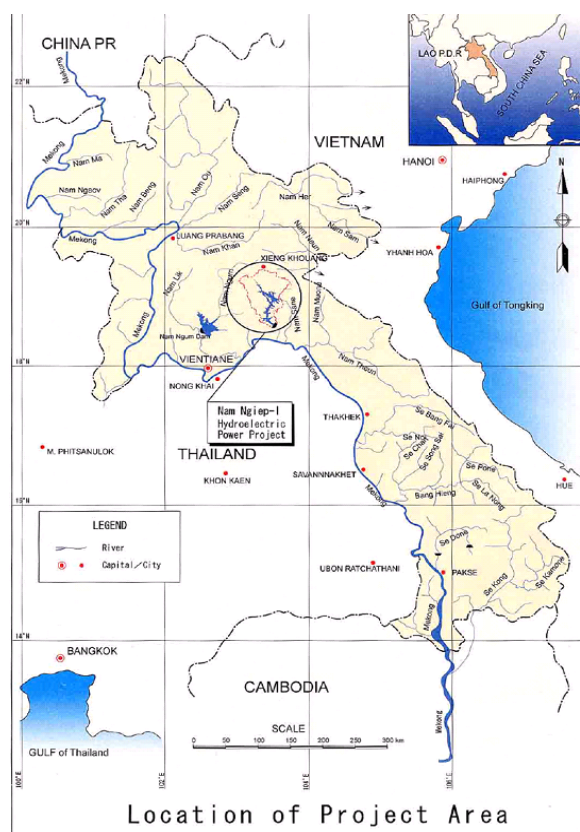
The Nam Ngiep originates in the mountains of Xieng Khouang Province, flowing through Khoum District into Thathom District of Xaysomboun Province, through Hom District and into Bolikhamxay Province. The Nam Ngiep meets the Mekong River just upstream from Pakxan in Bolikhamxay Province (Fig. 1-1).

**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 Bolikham 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.

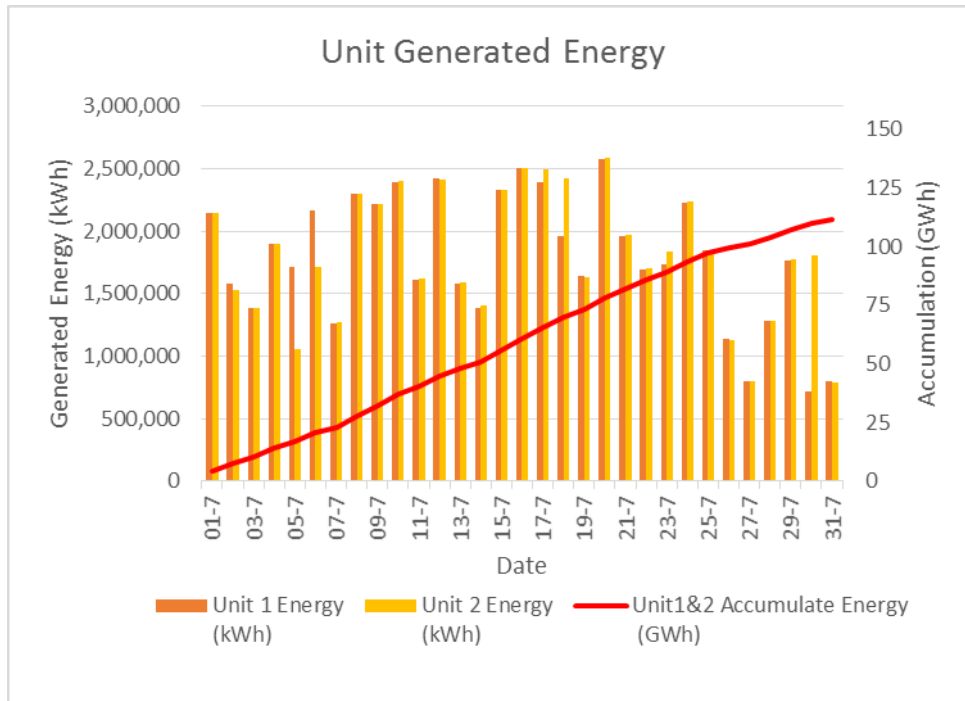
## 2.1 OPERATION AND POWER GENERATION

### 2.1.1 Power Production

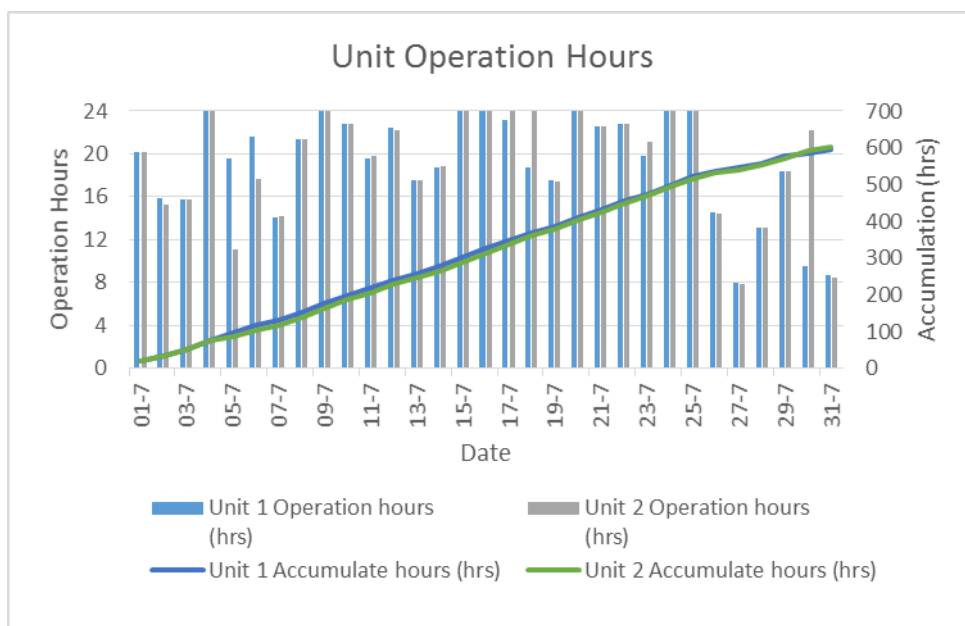
#### 2.1.1.1 Main Power Station

**Figure 2.1** and **Figure 2.2** shows the generation data at the main power station in July 2020. The generation was higher than the previous month.

**FIGURE 2-1: UNIT GENERATED ENERGY (MAIN POWER STATION)**



**FIGURE 2-2: UNIT OPERATION HOURS (MAIN POWER STATION)**



**Table 2-1** shows a summary of the main dam operation in July 2020

**TABLE 2-1: SUMMARY OF MAIN DAM IN JULY 2020**

Dam Data	Unit	Quantity
Main dam water level at Beginning of the Month	m asl	298.11
Main dam water level at End of the Month	m asl	297.04
Inflow	m <sup>3</sup> million	361.96
Turbine discharge	m <sup>3</sup> million	394.66
Spillage (excluding riparian release)	m <sup>3</sup> million	0.0

**Table 2-2, 2-3** and **2-4** shows the generation data at the main power station. In July 2020, the Actual Generation (109.45GWh) was almost the same as Aggregate Declaration (113.21GWh).

**TABLE 2-2 : SUMMARY OF MAIN POWER STATION IN JULY 2020**

Power Station Data	Unit	Quantity	
Generated Energy	GWh	111.47	
Delivery Energy at Delivery Point	GWh	109.45	
Station Service Energy	kWh	226,616	
		Unit 1	Unit 2
Period of Operation	Hours	594:35	601:03
Planned Outage	Hours	9:00	10:00
Unplanned Outage	Hours	15:12	4:00
Number of Unit Starts	No.	33	32

**TABLE 2-3 : ENERGY AMOUNT IN JULY 2020 (MAIN POWER STATION)**

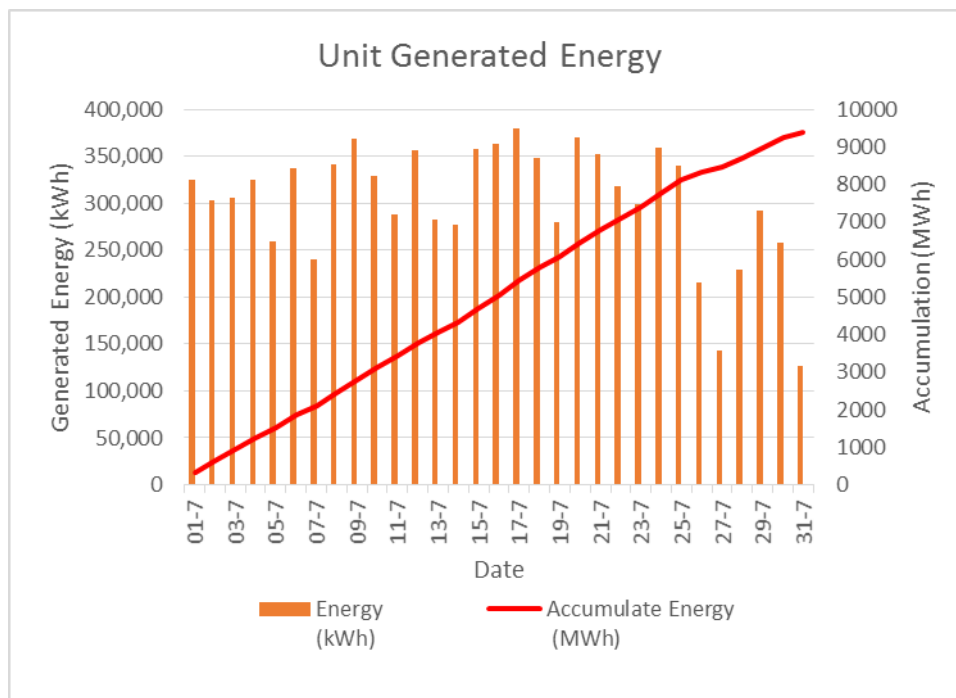
Month	Energy amount for the month (MWh)				Imported Energy (MWh)	Station Service Energy (MWh)
	Primary Energy	Secondary Energy	Excess Energy	Total		
January	104,444.6	0	0	104,444.6	182.5	146.0
February	92,536.8	0	0	93,536.8	174.6	157.3
March	61,790.7	0	0	61,790.7	224.5	172.0
April	44,676.9	0	0	44,676.9	131.9	148.6
May	51,541.1	0	0	51,541.1	212.9	187.4
June	51,227.3	0	0	51,227.3	202.2	180.7
July	109,358.1	100.7	0	109,458.834	94.6	226.6

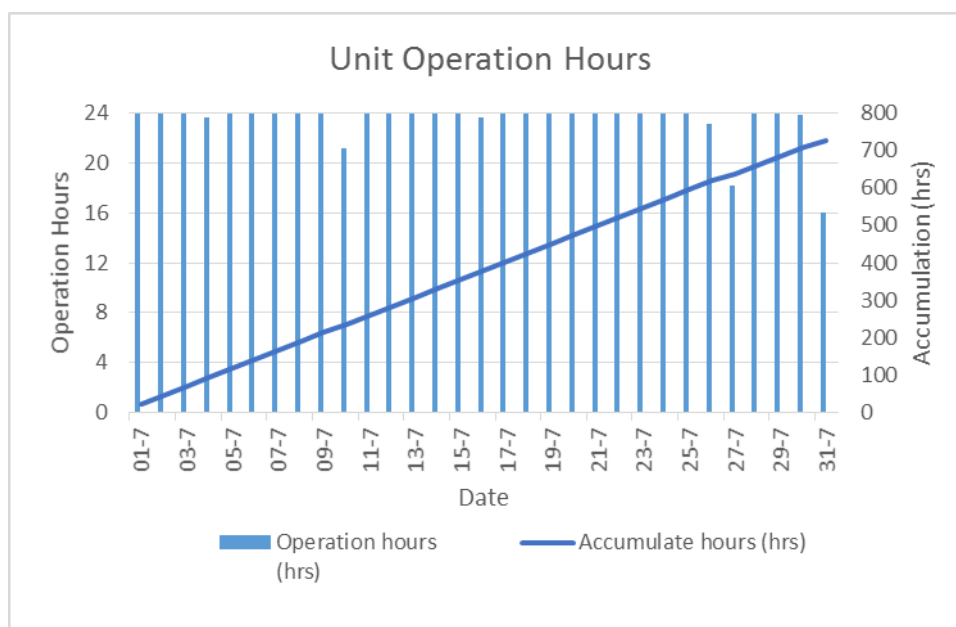
**TABLE 2-4 : DECLARATION (MAIN POWER STATION)**

Declaration	Unit	July 2020		August 2020 Aggregate Declaration
		Aggregate Declaration	Final Declaration	
Primary Energy	MWh	112,000	93,414	103,800
Secondary Energy	MWh	1,210	86	49,900
<b>Total</b>	<b>MWh</b>	<b>113,210</b>	<b>93,500</b>	<b>152,700</b>

### 2.1.1.2 Re-Regulation Power Station

**Figures 2-3** and **2-4** shows the generation data at the re-regulation power station in July 2020. The generation and operation time are affected by the operations of the main power station according to EGAT PPA. So, the amount of inflow is determined by the operation resulting at the main power station. Notwithstanding, even if the main power station is stopped, the specified 27 m<sup>3</sup>/sec water from re-regulation power station must be discharged to downstream.

**FIGURE 2-3: UNIT GENERATED ENERGY (RE-REGULATION POWER STATION)**

**FIGURE 2-4: UNIT OPERATION HOURS (RE-REGULATION POWER STATION)**

**Table 2-5, 2-6 and 2-7** shows the dam data at the re-regulation dam and generation data at the re-regulation power station.

**TABLE 2-5 : SUMMARY OF RE-REGULATION DAM IN JULY 2020**

Dam Data	Unit	Quantity
Dam Water Level at Beginning of the Month	m asl	178.76
Dam water Level at End of the Month	m asl	178.08
Inflow	m <sup>3</sup> million	394.66
Turbine Discharge	m <sup>3</sup> million	337.04
Spillage	m <sup>3</sup> million	58.47

**TABLE 2-6: SUMMARY OF RE-REGULATION POWER STATION IN JULY 2020**

Power Station Data	Unit	Quantity
Generated energy	GWh	9.60
Delivery Energy at billing meter	GWh	9.37
Station service energy	kWh	77,945
Operation Hour	Hours	725:48
Planned outage	Hours	0.00
Unplanned outage	Hours	4:01
Number of unit start	No.	8

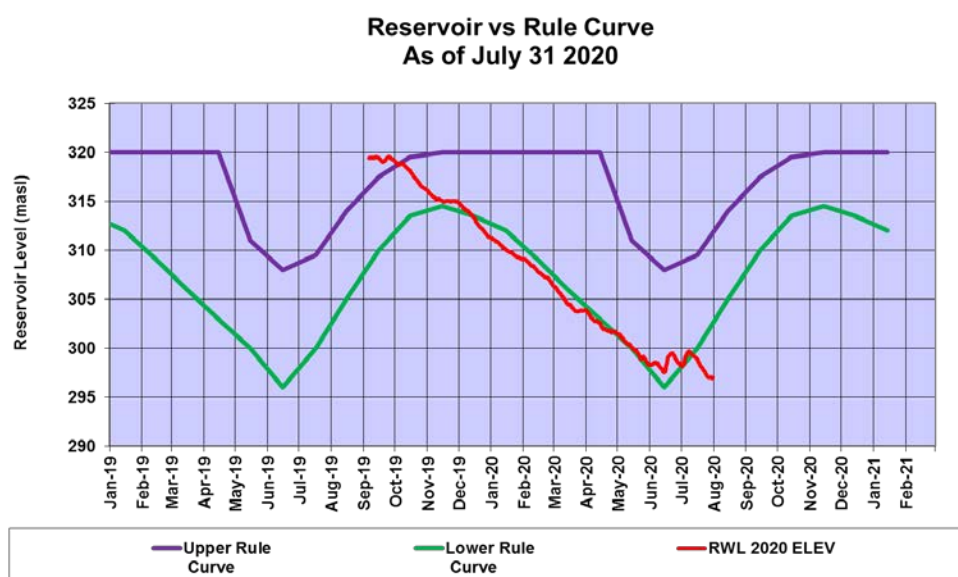
**TABLE 2-7: ENERGY AMOUNT IN JULY 2020 (RE-REGULATION POWER STATION)**

Month	Energy Amount for the Period (MWh)	Imported Energy (MWh)	Station Service Energy (MWh)
January	4,573	18.8	67.8
February	5,179	11.0	66.2
March	4,764	37.5	64.2
April	4,801	61.1	59.8
May	6,681	10.7	75.7
June	6,497	30.5	70.7
July	9,376	2.9	77.9

### 2.1.1.3 Reservoir Operation

**Figure 2-5** shows the dam water level compared with the rule curve. The dam was filled with water up to Full Supply Level at El. 320 m on 17 August 2019, but had slightly decreased because generating discharge was higher than inflow.

Actual dam water level decreased from the middle of July 2020 due to small amount of rain.

**FIGURE 2-5: DAM RESERVOIR LEVEL**



**2.1.2 Outage, Liquidated Damages and Unavailability****TABLE 2-8: UNAVAILABILITY AND SIGNIFICANT EVENT IN JULY 2020 (MAIN POWER STATION)**

Unit	Date/Time		Event	Outage Type	Period of Outage (Hours)
	Started	Finished			
1	07 July (08:43)	07 July (08:54)	Cooling water flow for turbine bearing low	Forced Outage	0:11
	17 June (23:12)	18 June (00:13)	Thrust bearing temperature high	Forced Outage	1:01
	18 July (08:00)	18 July (12:00)	Regular cleaning of cooling water system	Short Outage	4:00
	30 July (08:00)	30 July (17:00)	Regular cleaning of cooling water system	Planned Outage	9:00
	31 July (07:00)	31 July (17:00)	Changed relay setting for 22kV line	Short Notice Outage	10:00
2	19 July (08:00)	19 July (12:00)	Regular cleaning of cooling water system	Short Notice Outage	4:00
	31 July (07:00)	31 July (17:00)	Regular cleaning of cooling water system	Planned Outage	10:00

**TABLE 2-9: LIQUIDATED DAMAGE IN JULY 2020 (MAIN POWER STATION)**

<b>USD Portion</b>	<b>Baht Portion</b>
2,545.9	118,890.7

*(Estimation)***TABLE 2-10 : UNAVAILABILITY AND SIGNIFICANT EVENT IN JULY 2020 (RE-REGULATION POWER STATION)**

Unit	Date/Time		Event	Outage Type	Period of Outage (Hours)
	Started	Finished			
1	4 July (11:06)	4 July (11:30)	Cooling water flow low	Forced Outage	0:24
	10 July (19:13)	10 July (20:26)	22kV line tripped	Forced Outage	1:13
	16 July	16 July	Cleaning water flow sensor	Forced Outage	0:19

Unit	Date/Time		Event	Outage Type	Period of Outage (Hours)
	Started	Finished			
	(13:55)	(14:14)			
	26 July (14:50)	26 July (15:33)	22kV line tripped	Forced Outage	0:43
	26 July (18:13)	26 July (18:19)	Disconnecting of dropout fuse for recovering the trip	Forced Outage	0:06
	30 July (00:50)	30 July (00:59)	115kV line tripped	Forced Outage	0:09
	31 July (09:38)	31 July (10:45)	Changed relay setting for 22kV line	Forced Outage	1:07

## 2.2 MAINTENANCE WORK

The contract with Maintenance and Repair Contracting Company was made in November 2019 and expired in June 2020. An evaluation of bidding for new contract and contractor from July to December 2020 was concluded in June 2020.

The work activities were summarized as following:

1. Annual inspection test of Main Dam Spillway gates with EGAT PPA team to confirm an operation condition was conducted on 13 July 2020.
2. Carry out a monthly operation test for main facilities such as spillway gate, Gantry of intake gate at Main Dam, gantry of draft gate at Main Power house.
3. Carry out Main Dam, Re-regulation Dam facilities monitoring by weekly basis

**FIGURE 2-6: SPILLWAY GATE OPERATION WITH EGAT –PPA TEAM**



**FIGURE 2-7: OPERATION TEST OF GANTRY CRANE OF INTAKE GATE OF MAIN DAM**



## 2.3 CIVIL AND APPURTENANT STRUCTURE

### 2.3.1 Reservoir

**FIGURE 2-8: RESERVOIR OF MAIN DAM****FIGURE 2-9:: RESERVOIR OF RE-REGULATION DAM**

### 2.3.2 Dam and Power Plant

#### 2.3.2.1 Rehabilitation works

##### Plant Yards

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 2-10: RE-VEGETATION OF RCC PLANT YARD****FIGURE 2-11: RE-VEGETATION OF CVC PLANT YARD**

##### Quarry

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. Fence for safety was installed at top slope at right side. The grading at the quarry bottom and spreading of top soil was completed in January 2020.



**FIGURE 2-12: QUARRY AREA VIEW SHOWING RE-VEGETATION AND SAFETY FENCE INSTALLATION**

### 2.3.2.2 Disposal Areas and Solid Waste Landfill Sites

The operation of both HSRA and Project landfills is ongoing with collection waste materials from Resettlement “Phouhomxay”, neighbour villages and the Owner Site Office and Village.

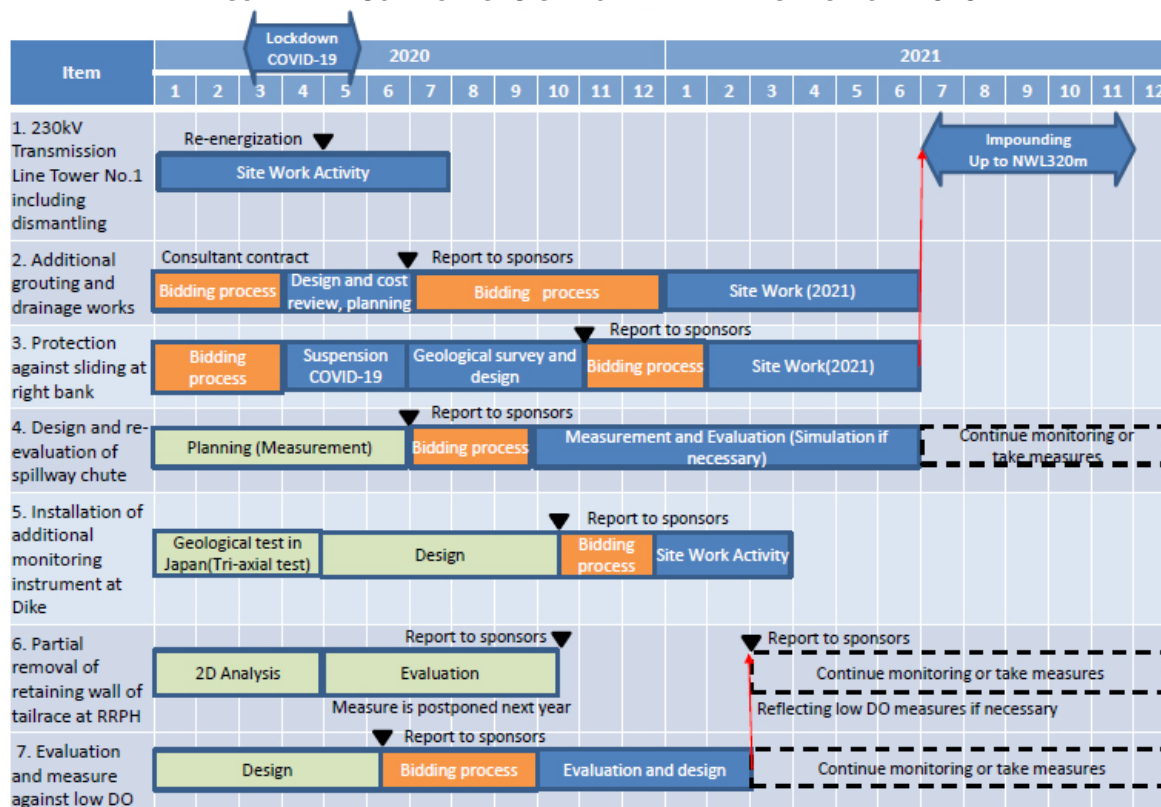
**FIGURE 2-13: PHASE 2 OF PROJECT LANDFILL DEVELOPMENT ON 08 JUNE 2017**

#### CURRENT CONDITION OF LANDFILL



### 2.3.2.3 Remaining Work

As shown in **Figure 2-13**, there remain seven items of significant works. Nos. 1, 2, 3, 4 are related to the main powerhouse and Nos. 5 and 6 are related to the re-regulation powerhouse. No. 7 is related to power operation and environmental issues.

**FIGURE 2-14: SCHEDULE OF SIGNIFICANT REMAINING WORKS IN 2020**

## 2.4 TRANSMISSION SYSTEM

### 2.4.1 Tower No.1 of 230 kV TL Replacement and Dismantling

The Tower No.1 was damaged due to the slope failure of approximately 150 m<sup>3</sup> volume of material above and behind Tower No.1 that occurred overnight on 17 to 18 of August 2019. Some of the structural steel members of the Tower No.1 were deformed. Tower No.1 did not move significantly but remained an unsafe structure. Movement of the upper part of the steel structure of the tower was observed.

Therefore, a Temporary Tower No.1 was constructed and the transmission line was moved to it from the damaged tower over the period 06 to 24 September 2019. The construction of the permanent Replacement Tower No.1, disassembly of existing Tower No.1 was contracted in late December 2019. The foundation excavation of legs for new Tower No.1 started in the middle of January 2020 and was completed on February 2020; the damaged Tower No.1 was almost dismantled in January 2020. The installation of gantry structure and new Tower No.1 was completed in the beginning of April 2020. Energization test was completed on 30 April 2020. Remaining works including slope protection around the Tower will be completed by August 2020 because earth work and concrete placement could not be done due to rain.



**FIGURE 2-15: TOP VIEW OF GANTRY STRUCTURE \_ SLOPE PROTECTION AROUND FOUNDATION ONGOING**

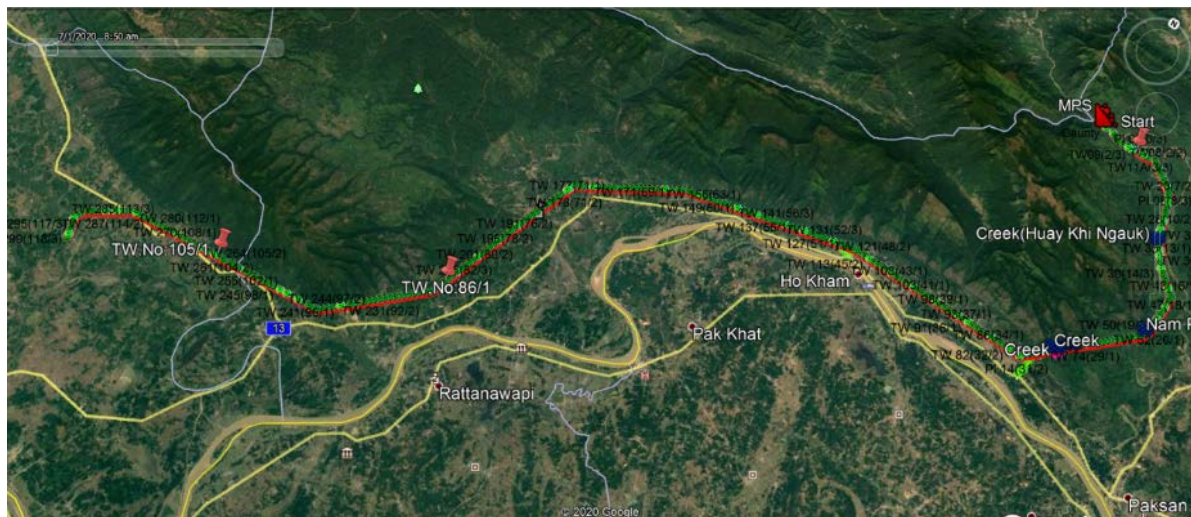


Site inspection of 230 KV transmission line route and condition for each tower from Main Power station to Nabong substation was conducted from June and 2020 completed in the middle of July 2020.

The activities were conducted as follows:

1. Checking of Access road condition,
2. Cutting high trees and cleaning vines climbing on towers, and
3. Fixing and replacement of stolen bolts, nuts and some part members.

**FIGURE 2-16: 230 KV TRANSMISSION LINE ROUTE FROM MAIN POWER STATION TO NABONG SUBSTATION**



**FIGURE 2-17: CUTTING HIGH TREES UNDER TRANSMISSION LINES**



**FIGURE 2-18: CLEANING VINES CLIMBING ON TOWERS**



**FIGURE 2-19: FIXING AND REPLACEMENT OF STOLEN PARTS (BOLT\_NUT)**



**FIGURE 2-20: FIXING AND REPLACEMENT OF STOLEN PART MEMBERS**



### 3. ENVIRONMENTAL MANAGEMENT MONITORING

#### 3.1 COMPLIANCE MANAGEMENT

In July 2020, the Environmental Management Office (EMO) of Nam Ngiep 1 Power Company (NNP1PC) received two Detail Work Program (DWP) and Site Specific Environmental Management and Monitoring Plans (SS-ESMMP) for review and approval. The status is presented in Table 3-1.

**TABLE 3-1: SS-ESMMP AND DOCUMENT REVIEW STATUS IN JULY 2020**

Title	Date Received	Status
DWP and SS-ESMMP for the <b>Monitoring Works on the Main Dam Body, Re-regulation Dam Body and Earth Dike Body</b> on the NNP1 project	08 July 2020 (1 <sup>st</sup> submission)	<b>No objection with comments on 13 July 2020.</b>  <b>Note:</b> On 28 July 2020, the revised document was submitted, but it did not fully address EMO's previous comments. Therefore, the document was returned to the Contractor with additional written instructions.
DWP and SS-ESMMP for the <b>Floating Debris removal on the Main Dam Reservoir, Re-regulation Dam Reservoir, the Access Roads, and Camp Facility Maintenance Works</b> on the NNP1 project	30 July 2020 (1 <sup>st</sup> 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 Table 3-2.

For the pending revegetation work at the LILAMA10 camp with the issued NCR level 1, EMO requested NNP1-TD to further coordinate with the HM Hydro Contractor to find alternative measures to complete the work by August 2020 to ensure successful revegetation during this wet season.

A newly opened NCR level 1 related to site rehabilitation requirement at the irrigation canal's rock and spoil disposal area of Phouhomxay Village. This NCR1 will be followed up and reported in the next MPR.

**TABLE 3-2: SUMMARY OF ONCs AND NCRs**

Items	ONC	NCR-1	NCR-2	NCR-3
Carried over from June 2020	4	1	0	0
Newly Opened in July 2020	0	1	0	0



<b>Total in July 2020</b>	<b>4</b>	<b>2</b>	<b>0</b>	<b>0</b>
Resolved in July 2020	2	0	0	0
Carried over to August 2020	2	2	0	0
Unsolved Exceeding Deadlines	2	2	0	0





### 3.1.1 Site Inspection by Environment Management Unit

The monthly site visit by the Bolikhan District EMU (Bolikhamxay Province) and the quarterly mission of EMU Xaysomboun Province were not carried out in July 2020.

### 3.1.2 Site Decommissioning and Rehabilitation

During the reporting period of July 2020, at 03 sites (spoil disposal area no.8, V&K camp and the main quarry) out of 08 revegetated sites, where the green cover is less than 70%, the Civil Works Contractor planted additional local grass species. The status of 03 sites mentioned above is shown in *FIGURE 3-1*.

**FIGURE 3-1: ADDITIONAL COUNTER MEASURES FOR THE SITE REHABILITATION IN JULY 2020**

<b>V&amp;K camp</b> Local grass species were additionally planted 	<b>SPOIL DISPOSAL AREA NO.8</b> Local grass species were additionally planted 
<b>MAIN QUARRY (TOP VIEW)</b> 	<b>MAIN QUARRY (BOTTOM VIEW)</b> 

## 3.2 ENVIRONMENTAL QUALITY MONITORING

The analyses of Total Suspended Solids (TSS), Biochemical Oxygen Demand (BOD5), Faecal Coliform, E. Coli Bacteria and Total Coliform have been carried out by NNP1PC'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 country's COVID-19 lockdown since mid-March 2020 until the end of July 2020, no water samples were shipped to UAE Laboratory in Thailand. The water samples were measured in-situ for dissolved oxygen, temperature, pH and conductivity and additional 5 parameters (TSS, BOD5, Faecal Coliform, E. coli Bacteria and Total Coliform) were analysed at NNP1PC Environmental Laboratory. Therefore, there are no results for COD, Ammonia-Nitrogen, Total Nitrogen, Total Phosphorus and Oil and Grease in this report.

### 3.2.1 Effluent Discharge from Camps and Construction Sites

Detailed monitoring results are provided in the Annex B of this Report. The effluent camp monitoring results in July 2020 indicated non-compliances for total coliform and faecal coliform in some camps.

The wastewater pipes in OSOV2 (ESD camp) were joined to transport all wastewater in the camp to be treated in one WWTS; therefore only 01 Effluent sampling site (EF13) remains in OSOV2 and EF14 sampling site has been cancelled commencing in July 2020.

No effluent was discharged from Main Powerhouse (EF19) in the second fortnight sampling.

The status of implementation of the corrective actions addressing non-compliances at the camps and key project facilities that continue to have non-compliances are summarized in *Table 3-3*

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

Site	Sampling ID	Status	Corrective Actions
<b>OSOV1</b>	EF01	Non-compliance for pH, faecal coliform and total coliform in the first fortnightly sampling. However, full compliance in the second fortnightly sampling	➤ On-going maintenance of the wetland ponds (weeding and harvesting reeds).
<b>OSOV2 (ESD Camp)</b>	EF13	Non-compliance for faecal coliform and total coliform.	➤ The WWTS at the former IHI camp (EF14) was joined with the former HM Hydro camp (EF13) for better management of operation and chlorination.

Site	Sampling ID	Status	Corrective Actions
Main Powerhouse	EF19	Full compliance.	-

### 3.2.2 Ambient Surface Water Quality Monitoring

The ambient surface water quality monitoring programme comprises five monitoring stations in the main reservoir (R01-R05), two stations in the re-regulation reservoir (R06 and R07), 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 locations of the monitoring stations are shown in *Figure 3-2*.

Due to the country's lockdown, only pH, DO, Conductivity, Temperature, Turbidity, TSS, BOD<sub>5</sub>, Faecal Coliform and Total Coliform were measured and analysed in July 2020.

The monitoring results for key parameters (DO, TSS and BOD<sub>5</sub>) during July 2020 are presented in *Table 3-4, Table 3-5 and Table 3-6*. The full set of data for June 2020 is attached in Annex A. In addition, the results for DO are presented as line graphs in *Figure 3-3*.

#### Main Reservoir

From 01 to 08 July 2020, the water level in the main reservoir increased from El. 298.1 m asl to El. 299.7 m asl, where after the water level decreased to El. 297.0 m asl on 31 July 2020.

Thermal stratification was observed in the main reservoir, oxycline and anoxic condition were also recorded at some stations. Compared to the previous month, the oxycline layer in the main reservoir occurred in a similar level but anoxic condition was observed at a deeper layer.

At R05, during July 2020, the DO level in the upper 5.0 m was generally between 6 and 8 mg/L, and an oxycline had formed at a depth between 7.0 and 9.5 m corresponding to El. 288 m asl – 290 m asl. The entire water column below 26.0 m had a DO level less than 1 mg/L.

At R04, the DO level in the upper 5.5 m was generally between 6 and 7 mg/L. The entire water column below 22.0 m had DO level less than 1 mg/L.

The DO level at R03 was recorded between 6 and 8 mg/L in the upper 4.5 m and generally less than 1 mg/L at the depth below 24.0 m.

At R02, the DO concentrations in the entire water column were generally between 4.4 and 9.1 mg/L.

At R01, the DO level at the surface was generally about 6 mg/L.

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 – 250 mg/L and low flow season means of 20 - 50 mg/L.

The BOD<sub>5</sub> measurement at R03, R04 and R05 in the epilimnion were less than 1 mg/L, but in the hypolimnion, BOD<sub>5</sub> was recorded at 10.8, 10.8 and 7.1 mg/L respectively.

### **Re-regulation Reservoir**

In July 2020, the turbine discharges from the main powerhouse varied between 70 m<sup>3</sup>/s and 227 m<sup>3</sup>/s and usually interrupted by night-time periods with no discharge.

The DO measurements at R06 and R07 representing turbine discharges from the main dam generally had DO concentrations below 4 mg/L in the entire water column.

The BOD<sub>5</sub> concentration in R06 and R07 were 8.9 and 7.3 mg/L respectively.

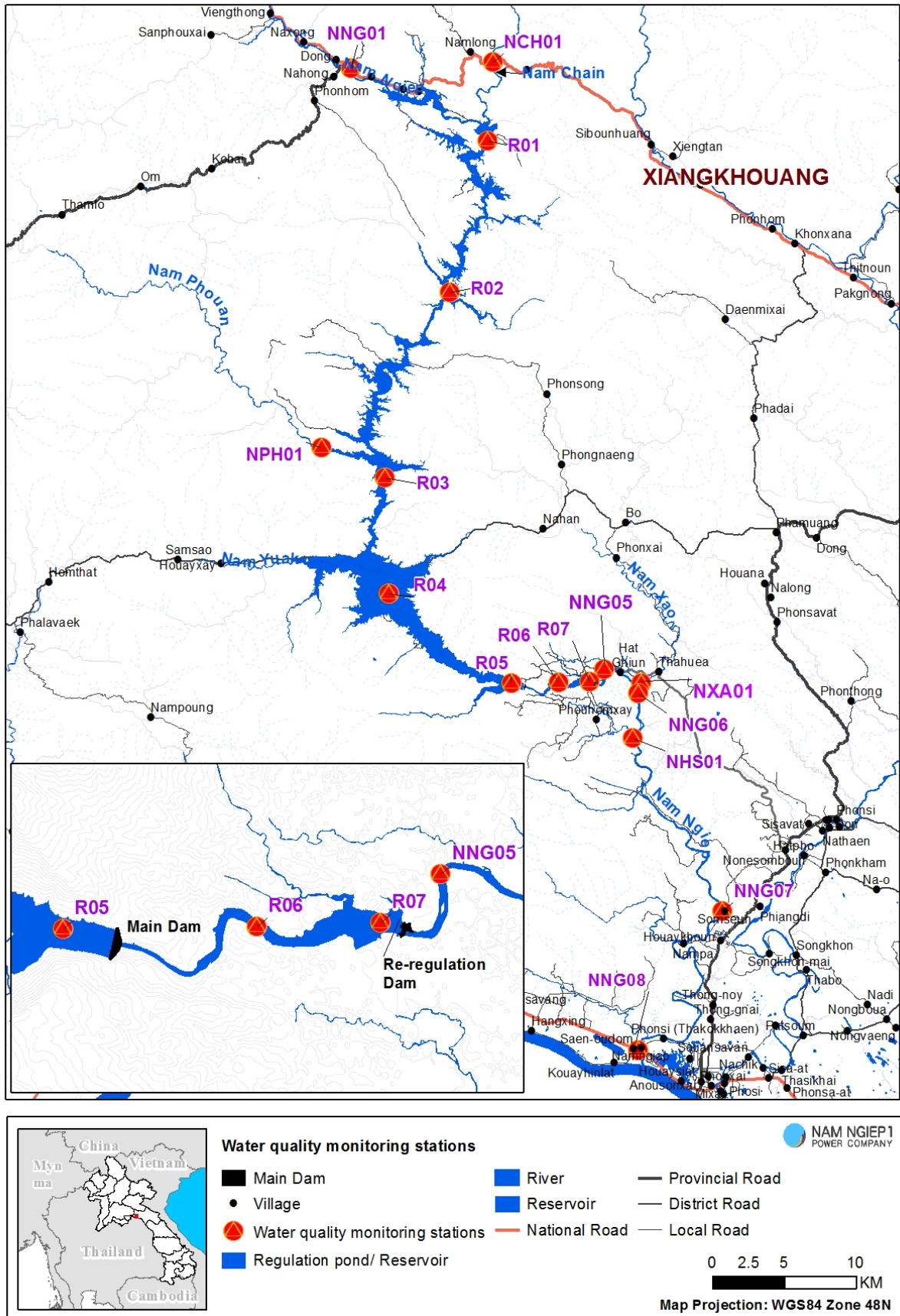
### **Downstream**

During July 2020, the discharge from the re-regulation dam was through the turbines. All DO concentrations (except on 15 and 30 July 2020 at NNG08) were less than 6 mg/L at the Nam Ngiep downstream stations and thus are non-compliant with the GoL Standard. No dead fish were observed in Nam Ngiep downstream during the periods with low DO. NNP1PC is in the process of collecting information to assist in the design of additional aeration structure to improve the DO level downstream.

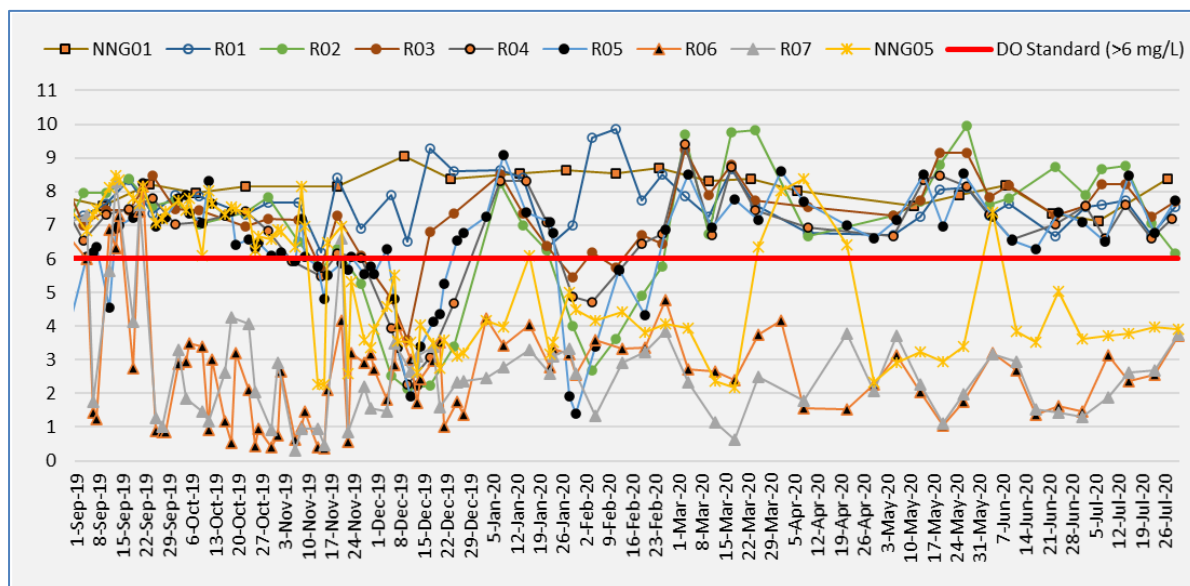
The BOD<sub>5</sub> in the downstream stations were below 3.8 mg/L.



**FIGURE 3-2: SURFACE WATER AND RE-REGULATION RESERVOIR WATER QUALITY MONITORING STATIONS**



**FIGURE 3-3: Concentration of Dissolved Oxygen in the Upper 0.2 m since September 2019 to July 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-Jul-20						7.08	1.48	1.3	3.62	4.15	4.41	5.72			6.9	6.98
2-Jul-20		7.5	7.89	7.58	7.56									8.4		
6-Jul-20	7.13												8.11			
7-Jul-20		7.6	8.66	8.23										8.8		
8-Jul-20					6.61	6.51										
9-Jul-20							3.13	1.89	3.72	3.71	5.02	5.86			7.41	7.47
14-Jul-20		7.7	8.76	8.22	7.6									8.73		
15-Jul-20						8.49	2.36	2.63	3.78	4.05	5.43	6.43			7.11	7.51
22-Jul-20		6.7	7.06	7.25	6.6									7.54		
23-Jul-20						6.77	2.56	2.68	3.98	4.25	4.91	5.18			5.66	6.42
27-Jul-20	8.39												7.83			
28-Jul-20					7.19											
29-Jul-20		7.6	6.16	7.69		7.72								8.61		
30-Jul-20							3.71	3.76	3.92	3.9	5.03	6.09			6.05	6.75

**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	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
6-Jul-20	71.8												17.36			
7-Jul-20		139		<5										22.65		
7-Jul-20 Hypolimnion				25.14												
8-Jul-20					<5	<5										
8-Jul-20 Hypolimnion					11.01	9.48										
9-Jul-20							<5	<5	<5	6.35	11.59	16.29			38.29	6.55

**TABLE 3-6: RESULTS OF SURFACE WATER QUALITY MONITORING FOR BOD<sub>5</sub> (MG/L) - WATER QUALITY STANDARD: < 1.5 MG/L**

BOD <sub>5</sub> (mg/L)	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
6-Jul-20	<1												<1			
7-Jul-20		<1		<1										<1		
7-Jul-20 - Hypolimnion				10.78												
8-Jul-20					<1	<1										
8-Jul-20 - Hypolimnion					10.84	7.14										
9-Jul-20							8.86	7.32	3.81	<1	<1	<1			<1	<1

### 3.2.3 Groundwater Quality Monitoring

During July 2020, community groundwater quality analyses were carried out for six wells located in Somseun Village, Nam Pa Village, Thong Noy Village, Pou Village and Phouhomxay Village.

The results indicated compliance with the groundwater quality standards for water supply purposes, except for faecal coliform and E.Coli bacteria as presented in Table 3-7.

**TABLE 3-7: GROUNDWATER QUALITY MONITORING RESULTS IN SOMSUEN, NAM PA, THONGNOY AND POU VILLAGES**

Parameter (Unit)	Site Name	Somseun Village	Nam Pa Village	Thong Noy Village	Pou Village	Phouhomxay Village	
	Station	GSXN01	GNPA01	GTHN01	GPOU01	GPHX01	GPHX02
	Guideline						
pH	6.5 - 9.2	7.28	7.01	7.79	7.3	6.74	6.57

Parameter (Unit)	Site Name	Somseun Village	Nam Pa Village	Thong Noy Village	Pou Village	Phouhomxay Village	
	Station	GSXN01	GNPA01	GTHN01	GPOU01	GPHX01	GPHX02
	Guideline						
Sat. DO (%)		79.9	92	75.8	96.8	32	36
DO (mg/L)		6.03	7.13	5.73	6.92	2.44	2.75
Conductivity (µS/cm)		255	374	296	58.2	122.2	256
Temperature (°C)		28.1	26.8	28.2	30.3	27.6	27.5
Turbidity (NTU)	<20	2.4	1.83	2.08	2.42	3.64	4.56
Faecal Coliform (MPN/100 mL)	0	2	4.5	49	4.5	47	7.8
E.coli Bacteria (MPN/100 mL)	0	2	4.5	33	4.5	40	7.8

### 3.2.4 Gravity Fed Water Supply (GFWS) Quality Monitoring

The results of analysed water quality are presented in *Table 3-8*. All parameters complied with the GoL Drinking Water Standards except for Faecal Coliform and E. Coli that exceeded the standards in all stations (WTHH02, WHGN02, WPHX01-intake before the filtration system, 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 monitoring results and were encouraged to boil water before drinking.

**TABLE 3-8: 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					
13-Jul-20	pH	6.5 - 8.6	8.02	7.89	8.03	8.54	8.72
13-Jul-20	Sat. DO (%)		103.6	97.2	100.9	94	101.4
13-Jul-20	DO (mg/L)		7.54	7.34	7.87	6.97	7.47
13-Jul-20	Conductivity (µS/cm)	<1,000	26.2	152.6	38.6	39.6	42.2
13-Jul-20	Temperature (°C)	<35	28.18	28.3	26.4	28.9	29.5
13-Jul-20	Faecal Coliform (MPN/100 mL)	0	1,600	170	130	79	79
13-Jul-20	E.coli Bacteria (MPN/100 mL)	0	1,600	170	130	79	79

### 3.2.5 Landfill Leachate Monitoring

During July 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 NNP1 Project Landfill leachate did not comply with the total coliform standard but Houay Soup Landfill leachate fully complied with the standard. However, the



leachate is still contained in the leachate ponds without discharging to the environment. EMO will continue to monitor the leachate and report the results in the next monthly progress report. The landfill leachate monitoring results for July 2020 can be found in *Table 3-9*.

**TABLE 3-9: RESULTS OF THE LANDFILL LEACHATE MONITORING**

		Site Name	NNP1 Landfill Leachate Monitoring						Houay Soup Landfill Leachate Monitoring		
			Location	Pond No.01	Pond No.02	Pond No.03	Pond No.04	Discharge Point		Last pond	Discharge Point
Date	Parameter (Unit)	Guideline									
3-Jul-20	pH	6.0-9.0				8.56		7.93			
3-Jul-20	Sat. DO (%)					85		94.3			
3-Jul-20	DO (mg/L)					6.44		7.1			
3-Jul-20	Conductivity (µS/cm)					81.5		256			
3-Jul-20	Temperature (°C)					27.9		28.3			
3-Jul-20	Turbidity (NTU)					22.22		14.57			
3-Jul-20	BOD <sub>5</sub> (mg/L)	<30				<6		7.77			
3-Jul-20	Faecal Coliform (MPN/100 mL)	<400				17		14			
3-Jul-20	Total Coliform (MPN/100 mL)	<400				1,700		920			

### 3.2.6 Discharge Monitoring

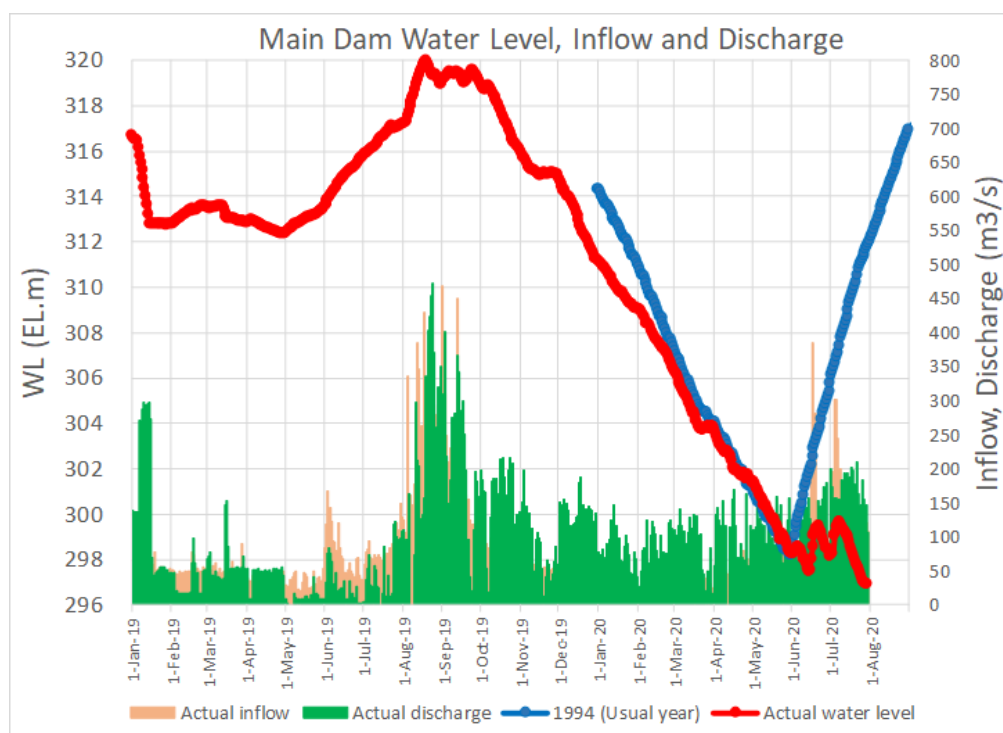
#### 3.2.6.1 Main Reservoir – Water Level, Inflow and Discharge

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 3-4.

During the first half of July 2020, the mean inflow to the main reservoir was about 180 m<sup>3</sup>/s where after the inflow decreased to a mean of about 95 m<sup>3</sup>/s during the remaining part of July 2020.

From 01 to 08 July 2020, the water level in the main reservoir increased from El. 298.1 m asl to El. 299.7 m asl, where after water level fell 2.7 m to 297.0 m asl on 31 July 2020.

In July 2020, the turbine discharges from the main powerhouse varied between 70 m<sup>3</sup>/s and 227 m<sup>3</sup>/s and usually interrupted by night-time periods with no discharge.

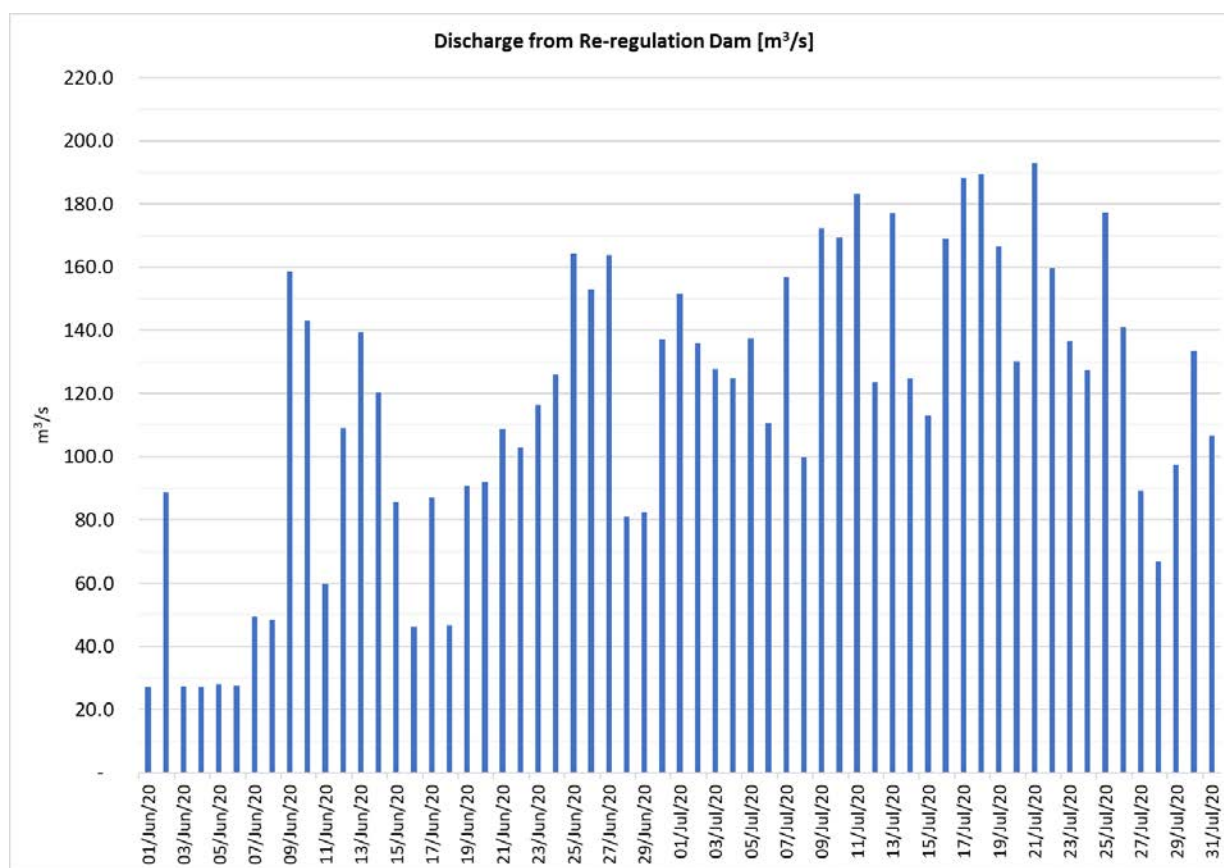
**FIGURE 3-4: WATER LEVEL, INFLOW AND DISCHARGE FOR THE MAIN RESERVOIR**

### 3.2.6.2 Re-regulation Reservoir – Discharge

The discharge monitoring data for the re-regulation dam during June and July 2020 is presented in Figure 3-5.

During July 2020, the mean discharge from the re-regulation dam was about 140 m³/s with turbine discharges varying between 50 and 160 m³/s, and periods also with gate discharge varying between about 30 m³/s and 60 m³/s.

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 3-5: DISCHARGE MONITORING AT THE RE-REGULATION DAM IN JUNE AND JULY 2020**

### 3.2.7 Nam Ngiep Downstream Water Depth Monitoring

In July 2020, EMO carried out five 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 but none of them were found to be difficult to navigate.

## 3.3 PROJECT WASTE MANAGEMENT

### 3.3.1 Solid Waste Management

In July 2020, a total of 19.6 m<sup>3</sup> of solid waste was disposed at the NNP1 Project Landfill, an increase of 0.2 m<sup>3</sup> compared to June 2020.

During July 2020, the local waste collection Contractor continued with the routine waste disposal and maintenance activities which included a bi-weekly waste covering, cutting grass and cleaning-up sediment from the ditch surrounding the leachate ponds to prevent run-off from entering the ponds.

No of recyclable waste was sold this month and the cumulative amounts are presented in Table 3-9.

**TABLE 3-10: AMOUNTS OF RECYCLABLE WASTE SOLD**

Source and Type of Recycled Waste		Unit	Sold	Cumulative Total by July 2020
1	Plastic bottle	kg	0	62
2	Aluminium	kg	0	64
3	Paper/Cardboard	kg	0	58
4	Glass	kg	0	53
<b>Total</b>		<b>kg</b>	<b>0</b>	<b>237</b>

The villagers from Phouhomxay Village collected a total of 822 kg of food waste from the OSOV1 canteen for animal feed in July 2020, same amount as previous month.

### 3.3.2 Hazardous Materials and Waste Management

The types and amounts of hazardous material and hazardous waste stored on site in July 2020 are shown in *Table 3-11* and *Table 3-12*.

**TABLE 3-11: RECORD OF HAZARDOUS MATERIAL INVENTORY**

No.	Type of Hazardous Material	Unit	Total in July 2020 (A)	Used (B)	Remainder (A – B)
1	Diesel	Litre	6,416	4,050	2,366
2	Gasoline	Litre	825	221	604
3	Lubricant (Turbine oil)	Litre	7,200	0	7,200
4	Colour Paint	Litre	266	0	266
5	Thinner	Litre	12	0	12
6	Grease Oil	Litre	440	0	440
7	Gear Oil	Litre	100	0	100
8	Chlorine Liquid	Litre	80	70	10
9	Chlorine Powder	Kg	65	0	65
10	SIKA	Litre	7	0	7

**Note:** Starting by this MPR, the unit of Colour Paint, Thinner, Grease Oil and Sika were changes from drum/can to Liter.

**TABLE 3-12: RECORD OF HAZARDOUS WASTE INVENTORY**

No.	Hazardous Waste Type	Unit	Total in June 2020 (A)	Dispose (B)	Remainder (A - B)
1	Used Oil (Hydraulic and Engine)	Litre	126	0	126
2	Empty 200L drum of used oil	Unit	3	0	3
3	Contaminated soil, sawdust and textile material	m <sup>3</sup>	0.4	0	0.4

No.	Hazardous Waste Type	Unit	Total in June 2020 (A)	Dispose (B)	Remainder (A - B)
4	Empty paint and spray cans	Can	106	0	106
5	Halogen/fluorescent bulbs	Unit	231	0	231
6	Empty cartridge (Ink)	Unit	145	0	145
7	Clinic Waste	Kg	10.9	0	10.9

### 3.4 COMMUNITY WASTE MANAGEMENT

#### 3.4.1 Community Recycling Programme

In July 2020, there was no incoming recyclable waste to the Community Recycle Waste Bank. The total amount of recyclable waste stored in the waste bank remained the same amount as in the previous month.

**TABLE 3-13: TYPES AND AMOUNTS OF RECYCLABLE WASTE TRADED AT THE COMMUNITY RECYCLE WASTE BANK**

Types of Waste	Unit	Remaining in June 2020	Additional in July 2020	Sold/dispose	Remaining in July 2020
Glass bottles	kg	2,249	0	0	2,249
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
<b>Total</b>	<b>kg</b>	<b>3,137</b>	<b>0</b>	<b>0</b>	<b>3,137</b>

#### 3.4.2 Community Solid Waste Management

Approximately 15.3 m<sup>3</sup> of solid waste was collected from the host and Phouhomxay Villages for disposal at Houay Soup landfill, a decrease of 1.8 m<sup>3</sup> compared to June 2020.

### 3.5 WATERSHED AND BIODIVERSITY MANAGEMENT

#### 3.5.1 Watershed Management

##### 3.5.1.1 Implementation of Annual Implementation Plan (AIP) 2019

Xaysomboun Provincial WRPO conducted TPZ boundary survey and verification between 8-26 June 2020 in Hom and Anouvong Districts. The official minutes of meeting (MOM) on the boundary verification of TPZ2 within Nampoung and Phoukhata Village was signed on 12 and 14 June 2020 respectively while the official MOM on the boundary verification of TPZ1 within Tamlo, Om, and Korhai village was signed on 24, 26, and 28 June 2020 respectively. Xaysomboun provincial WRPO and NNP1PC EMO team worked on the GIS map to view the area changes between the originally proposed and after boundary verification. The team will further discuss with BSP on the results especially on the impact on the NNL calculation.

Xaysomboun Provincial WRPO also conducted reservoir patrol activities between 19-26 June 2020 in the reservoir Zone 4 of Thathom District and in the reservoir Zone 2 and 3 of Hom District.

The patrol team observed boat and fishing equipment along Sopkhaiy to Kao village and forest encroachment for rice cultivation and rubber plantation within reservoir zone 4. The patrol team coordinated with DAFO-Tathom for further actions. The patrol team issued a total of six warning letters related to the activities within reservoir Zone 2 and 3 to 16 people with nine boats and 37 fishing gill nets and some fishing rods as well as for the family who did the rice cultivation within proposed TPZ1.

A working session on SMART for patrol team of Xaysomboun Provincial WRPO was organized on 17 July 2020. The meeting was attended by four representatives of BSP, three representatives of NNP1PC EMO, and three representatives from Xaysomboun provincial WRPO. The SMART and its database for patrolling work were presented and discussed followed by short field exercise on the use of GPS and filling up the SMART form. Further training on filling the SMART form and database was scheduled in August 2020 and the establishment of SMART system was scheduled in September 2020.

Bolikhamxay Provincial WRPO did not implement any activities during this reporting period. The kick-off meeting and working session on SMART for the patrol team of Bolikhamxay Provincial WRPO was organized on 30 July 2020.

The Fishery Consultant submitted the improved final draft of Fishery Co-Management Plan (FCMP) in English on 31 July 2020. The final draft is being reviewed by NNP1PC EMO prior further submission to ADB and approval by Xaysomboun PAFO.

NNP1PC and the Livelihood Consultant have improved the final report of assessment on sustainable livelihood opportunities for NNP1 watershed communities based on the technical workshop in May 2020. NNP1PC EMO provided further comments to the consultant on 21 July 2020 and the improved final report was submitted on 31 July 2020.

### **3.5.2 Biodiversity Offset Management**

#### **3.5.2.1 Engagement of Biodiversity Service Provider (BSP)**

ADB shared the final draft of MOU with NNP1PC for confirmation on 17 June 2020. NNP1PC have further improved the final draft per discussion with NNP1PC lawyer, management, and shareholder. The improved draft was communicated to BSP and ADB on 27 July 2020.

NNP1PC-EMO and the BSP continued to make progress by having many unofficial discussions via phone calls and emails on several topics such as the preparation of a Law Enforcement Strategy (LES) document for NC-NX offset site, the overall biological monitoring program for NNP1 watershed and NC-NX offset site, community outreach program, conservation linked livelihood and the training on patrolling and SMART.

#### **3.5.2.2 Implementation of BOMP Annual Implementation Plan (AIP) 2019 and 2020**

Bolikhamxay Provincial NC-NX BOMU received the fund for the implementation of activities under the first and second quarters of AIP2020 from DOF-MAF on 08 June 2020.

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

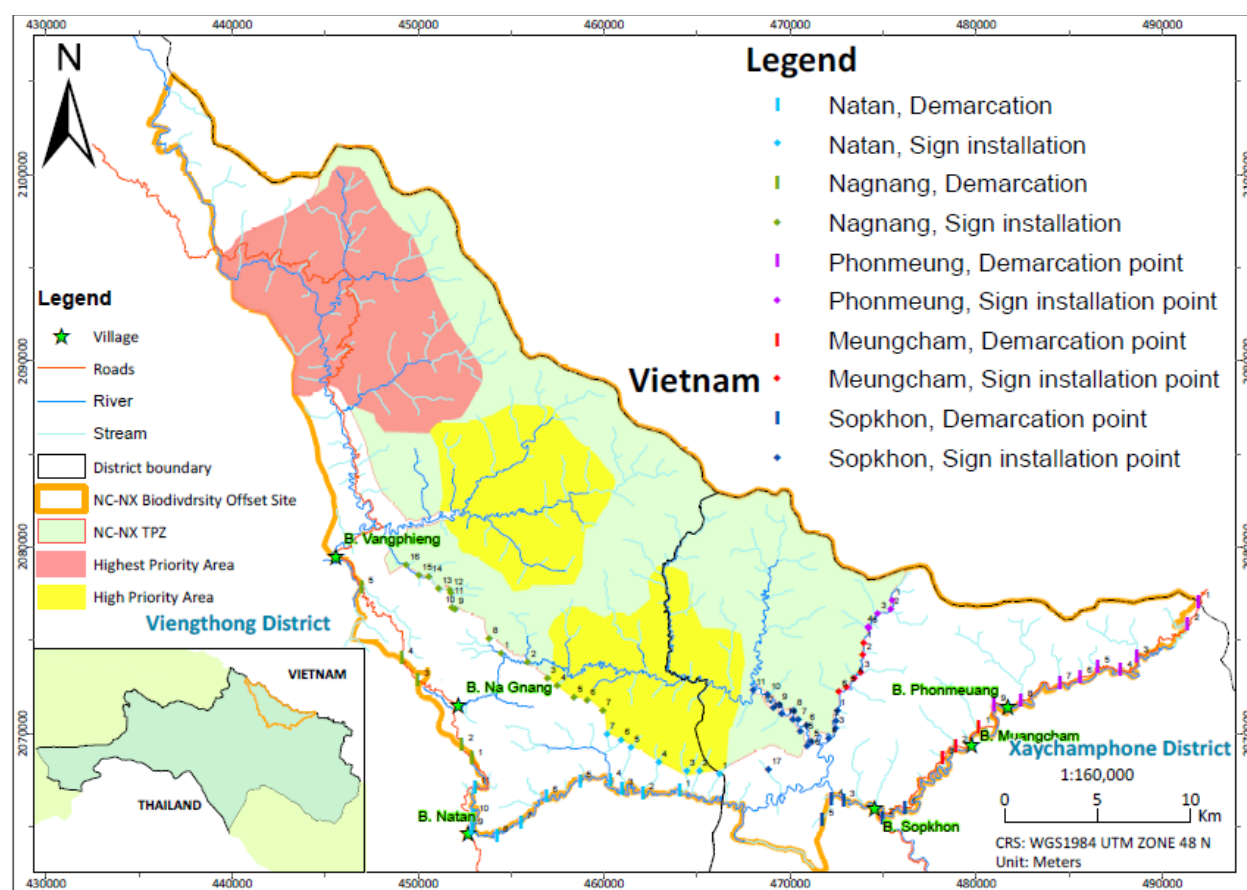
##### **a. Component 1 - Spatial Planning and Regulation**

Bolikhamxay Provincial NC-NX BOMU resumed the NC-NX boundary post demarcation and TPZ signage installation in the five remaining villages from 17 June to 02 July 2020.

The team completed 17 demarcation posts and installation of 27 TPZ signs in Phonmeuang, Meungcham and Sopkhon villages of Xaychamphone District. One sign could not be installed in Meungcham Village because the villager proposed to use the area as rice paddy in the future. In addition, three demarcation posts in Sopkhon Village could not be completed due to access difficulty. The team also completed 16 demarcation posts and installation of 23 TPZ signs in Natan and Na Gngang village of Viengthong District. The team could not complete two demarcation posts and one TPZ sign installation in Na Gngang Village because of heavy rain and access difficulty.

Bolikhamxay Provincial BOMU have consulted with Bolikhamxay Provincial BOMC and PAFO and noted that the Meungcham Village should respect the agreement on TPZ boundary dated in August 2019 because this agreement came from throughout consultation between villagers and relevant authorities. The Head of BOMU advised the team to conduct the dissemination and outreach activity in the completed villages within August 2020, to complete the installation of the remaining signage and demarcation posts after the rainy season in October 2020, and to obtain the endorsement for district authority in November 2020.

**FIGURE 3-6: MAP OF NC-NX POST DEMARCATION AND TPZ SIGNAGE INSTALLATION**



## b. Component 2 – Law Enforcement

The four patrol teams continued the patrolling between 10 to 30 July 2020 with the focus on the TPZ highest priority area around Thongnachang and Nam San; TPZ high priority areas around Nam Ma, Nam Sa Nga, Nam Kapong, Nam Houng and Sanluang; and Nam Lak in Xaychamphone District. The results of July 2020 patrolling will be presented and discussed in August 2020 Monthly Report.

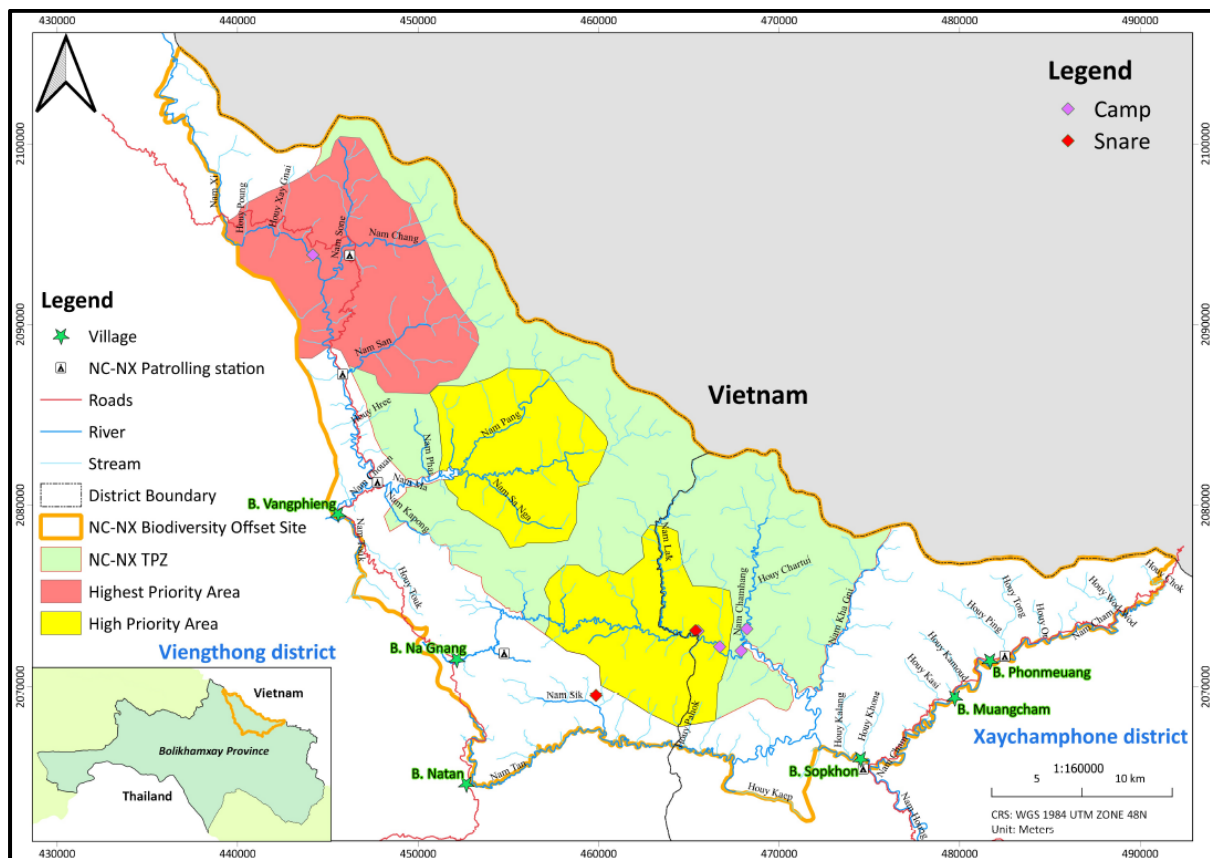
The results of patrolling activity in June 2020 are as follows:



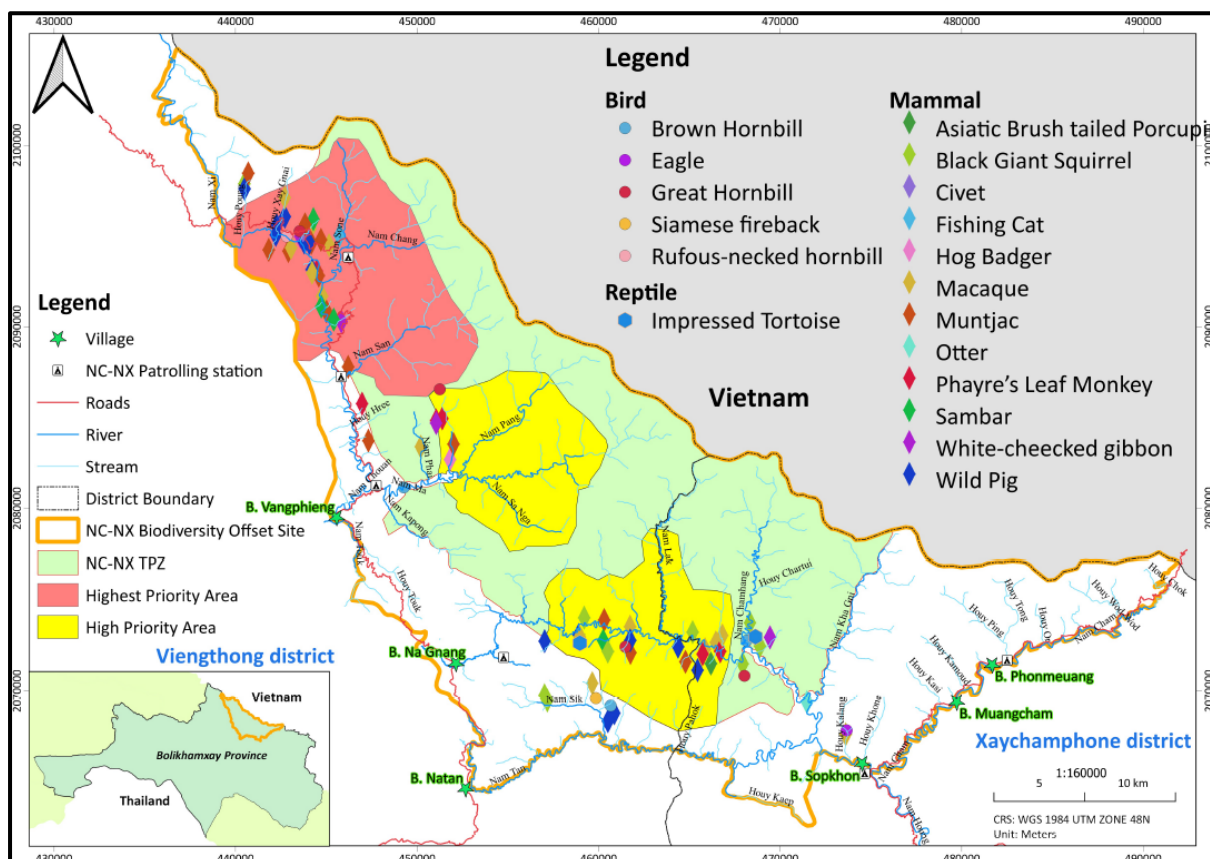
- *The first team* carried out patrolling at TPZ highest priority area including Nam San, Nam Xi, Nam Sone, Houay Xainoy, Houay Xaiyai, Nam Chang, Houay Poug, Nam Chouane and Houay Phalai. They spent 15 days covering a distance of 53 km on forest patrolling and 29 km on road patrolling. The team made a total of five direct observations and 10 indirect observations of the following wildlife: Macaque, Muntjac, Phayre's leaf monkey, Wild pig, Great Hornbill, Rufous-necked hornbill, Sambar, and White-cheeked gibbons. The team also encountered one inactive fishing camp around Nam Xi. The camp was destroyed by patrolling team.
- *The second team* carried out patrolling at Nam Ma TPZ high priority area including Nam Ma, Nam Mong, Nam Kapong, Houay Phaphard, Houay Phalai, Houay Hree and Houay Phai. They spent 15 days covering a distance of 77 km on forest patrolling and 18 km on road patrolling. The team made a total of six direct observations and one indirect observations of the following wildlife: Brown Hornbills, Great Hornbills, Hog Badger, Macaque, Phayre's leaf monkey, White-cheeked gibbons, and Muntjac. The team did not encounter any threats during the patrolling.
- *The third team* carried out patrolling at Xaychamphone district area including Nam Houg, Nam Chamhang, Houay Kasae, Houay Khone and Houay Kalang. They spent 16 days covering a distance of 68 km on forest patrolling and 24 km on road patrolling. The team made a total of 10 direct observations and two indirect observations of the following wildlife: Asiatic Brush tailed Porcupine, Black Giant Squirrels, Brown Hornbill, Eagle, Great Hornbills, Impressed Tortoise, Macaque, Phayre's Leaf Monkey, White-cheeked gibbons, Wild pig, and Muntjac. The team also encountered a number of threats such as four small inactive fishing camps at Nam Chamhang and Nam Houg and one line of small wire snares with a total of 100 individual snares at Nam Houg. The snares were removed from the area and the camps were destroyed by patrolling team.
- *The fourth team* carried out patrolling at Nam Houg TPZ high priority area including Nam Houg, Nam Sik, Nam Kha Gna and Nam Tong. They spent 14 days covering a distance of 66 km on forest patrolling. The team made a total of five direct observations and three indirect observations of the following wildlife: Black Giant Squirrel, Brown Hornbills, Great Hornbill, Impressed Tortoise, Macaque, Muntjac, Sambar, and Wild pig. The team also encountered one line of large wire snare with a total of 47 individual snares around Nam Sik that were later on removed by the patrolling team.



**FIGURE 3-7: MAP OF THREATS RECORDED BY PATROLLING TEAMS IN JUNE 2020**



**FIGURE 3-8: MAP OF WILDLIFE SIGNS RECORDED BY PATROLLING TEAMS IN JUNE 2020**





**FIGURE 3-9: FISHING CAMP OBSERVED BY TEAM 1 AT NAM XI, VIENGTHONG DISTRICT**



**FIGURE 3-10: FISHING CAMP OBSERVED BY TEAM 3 AT NAM CHAMHUNG**



**FIGURE 3-11: SMALL WIRE SNARE COLLECTED AT NAM HOUNG BY TEAM 3**



**FIGURE 3-12: CARCASS OF SILVER PHEASANT AT MOUNTAIN RIDGE ALONG NAM SIK BECAUSE OF THE LARGE WIRE SNARE**



**FIGURE 3-13: HOG BADGER**



**FIGURE 3-14: PHAYRE'S LEAF MONKEY**



### c. Component 3 – Conservation Outreach

The process of outreach strategy development was presented by BSP during the monthly meeting on 09 July 2020 as it will be developed through the process of Annex 13 of BOMP: NC-NX Outreach Development. It was noted that the pre-assessment of the target audiences is necessary before the strategy and annual outreach plan can be developed. BSP will further

prepare for the pre-assessment questionnaires, update the timeline and share to NNP1 and BOMU in August 2020.

#### d. Component 4 – Conservation linked livelihood development

The final technical workshop on the CDP was organized on 30 June - 01 July 2020. The Consultant submitted the first draft of CDP based on the field assessment and final technical workshop on 13 July 2020. NNP1PC EMO provided the comments and had further discussions with the Consultant on 16 and 23 July 2020 respectively. The Consultant submitted the improved first draft on 31 July 2020 and it is being reviewed by NNP1PC EMO.

BSP have drafted the Community Snare Removal Plan (Lao version). The first draft was shared to NNP1PC EMO on 07 July 2020 and comments were provided on the same date. The second draft was shared on 15 July 2020 and NNP1PC EMO have provided further comments on 23 July 2020. The third draft was submitted to NNP1PC EMO on 28 July 2020 and shared to Bolikhamxay Provincial BOMU on 30 July 2020 for further comments.

#### e. Component 6 – Biological Monitoring

The supplier has delivered forty units of camera trap (Bushnell Core Low Glow Trail Camera) to NNP1PC EMO on 15 July 2020.

BSP has prepared the matrix of biological monitoring for NNP1 watershed and NC-NX offset site under NNL objective. The draft was shared to NNP1PC EMO on 22 July 2020 and further discussed with NNP1PC EMO Biodiversity team on 23 July 2020. The matrix is being further reviewed by NNP1 EMO team and management.

### 3.6 FLOATING DEBRIS REMOVAL

There was no field work carried out during this reporting period.

## 4. FISHERY MONITORING

Three species groups and two species dominated the fish catch by weight in June 2020 as listed in *Table 4-1*. All species are classified as Least Concern (LC) according to the IUCN Red List of Threatened Species<sup>1</sup>, except *Tor sinensis* is classified as Vulnerable (VU).

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

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
<i>Hampala dispar</i> , <i>Hampala macrolepidota</i>	ປາສູດ	158.6	LC

<sup>1</sup> 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
<i>Pangasius conchophilus</i>	ປາຢາງ	113.5	LC
<i>Poropuntius normani</i> , <i>Poropuntius laoensis</i> , <i>Poropuntius carinatus</i>	ປາຈາດ	125.9	LC
<i>Tor sinensis</i>	ປາແດງ	104.2	VU
<i>Barbonymus gonionotus</i> , <i>Hypsibarbus malcomi</i> , <i>Hypsibarbus vernayi</i> , <i>Hypsibarbus wetmorei</i>	ປາປາກ	116.1	LC

The recorded catch of Threatened and Near Threatened species (IUCN Red List classification) in June 2020 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 JUNE 2020 FISH CATCH**

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
<i>Cirrhinus molitorella</i>	ປາແກງ	3	NT
<i>Neolissochilus stracheyi</i>	ປາສອງ	3.8	NT
<i>Onychostoma gerlachi</i>	ປາຄີງ	8	NT
<i>Scaphognathops bandanensis</i>	ປາວຽນໄຟ/ປາປ່ຽນ	12.7	VU
<i>Tor sinensis</i>	ປາແດງ	104.2	VU
<i>Wallago attu</i>	ປາຄ້າວ	2.3	NT

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 June 2020 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 MONTHLY FISH CATCH JULY 2015 – JUNE 2020**

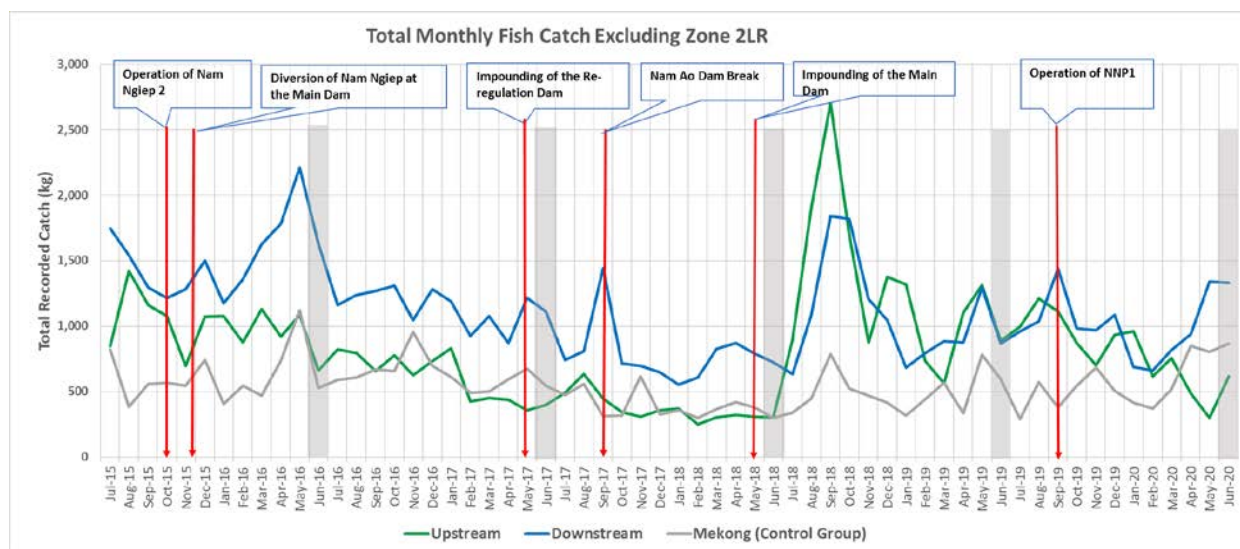
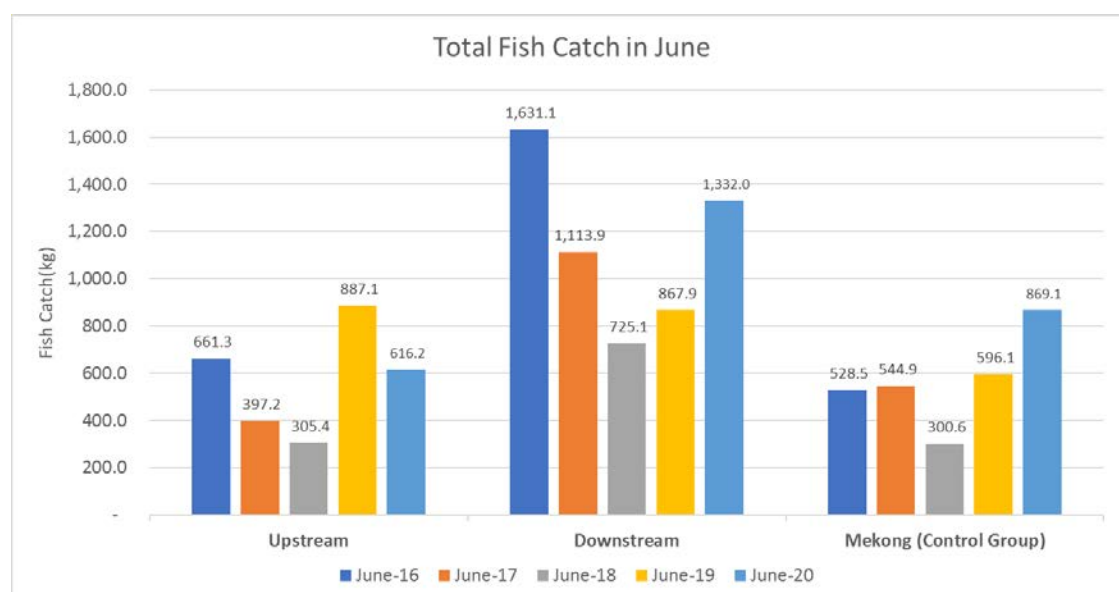


Table 4-3 and Figure 4-2 show the total recorded fish catch for the month of June from 2016 to 2020 in the upstream (excluding Zone 2LR) and downstream communities and the Mekong control group. The total fish catch data represents the total fish supply provided by the involved fishing households.

**TABLE 4-3: TOTAL FISH CATCH BY UPSTREAM (EXCLUDING ZONE 2LR), DOWNSTREAM AND MEKONG CONTROL GROUP FISHING HOUSEHOLDS FOR THE MONTH OF JUNE FROM 2016 TO 2020**

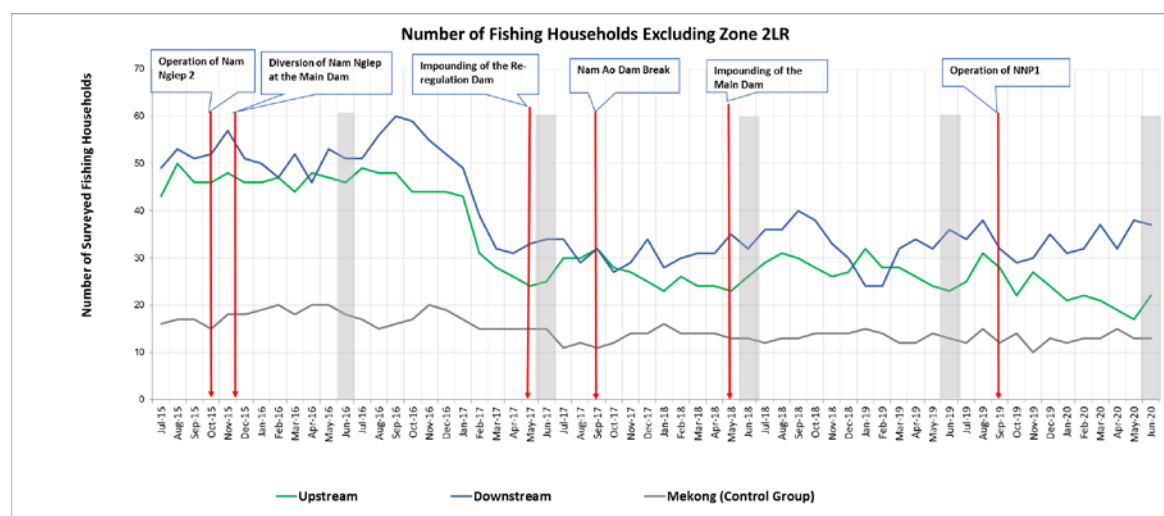
Fishing Zone	June 2016 (kg)	June 2017 (kg)	June 2018 (kg)	June 2019 (kg)	June 2020 (kg)
Upstream	661.3	397.2	305.4	887.1	616.2
Downstream	1,631.1	1,113.9	725.1	867.9	1,332.0
Mekong Control Group	528.5	544.9	300.6	596.1	869.1

**FIGURE 4-2: TOTAL FISH CATCH BY UPSTREAM (EXCLUDING ZONE 2LR), DOWNSTREAM AND MEKONG CONTROL GROUP FISHING HOUSEHOLDS FOR THE MONTH OF JUNE FROM 2016 TO 2020**

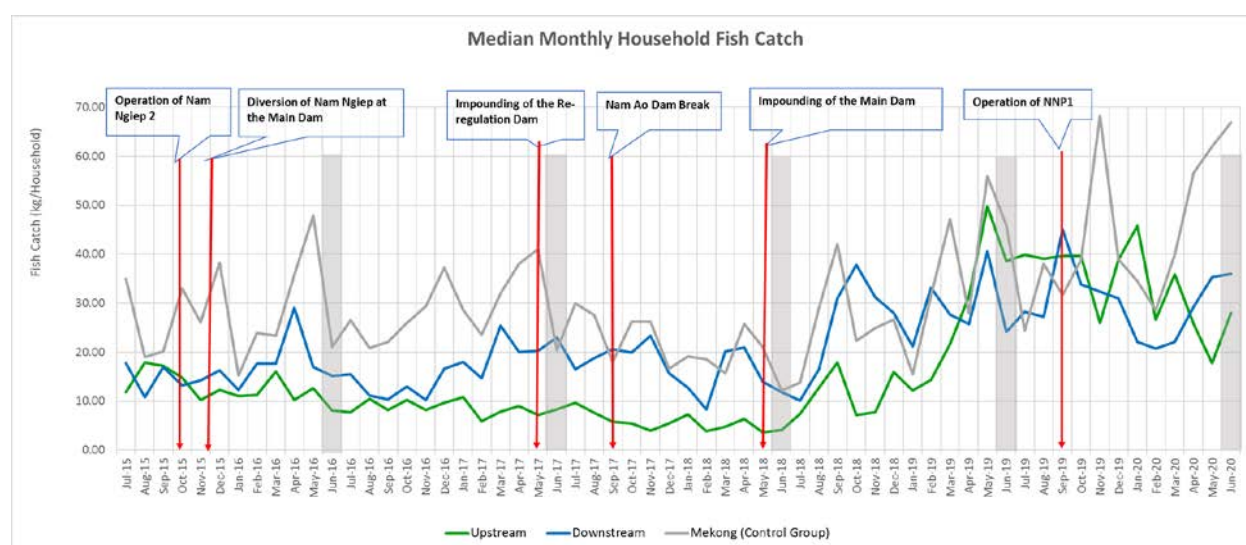


The numbers of fishing households involved in the fish catch monitoring programme are displayed in Figure 4-3.



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


The median monthly household fish catch from July 2015 to June 2020 for the upstream (excluding Zone 2LR) and downstream communities, and the Mekong control group are presented in **Figure 4-4**.

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


The median household fish catch for the month of June from 2016 to 2020 in the upstream (excluding Zone 2LR) and downstream communities and the Mekong control group are displayed in **Table 4-4**.

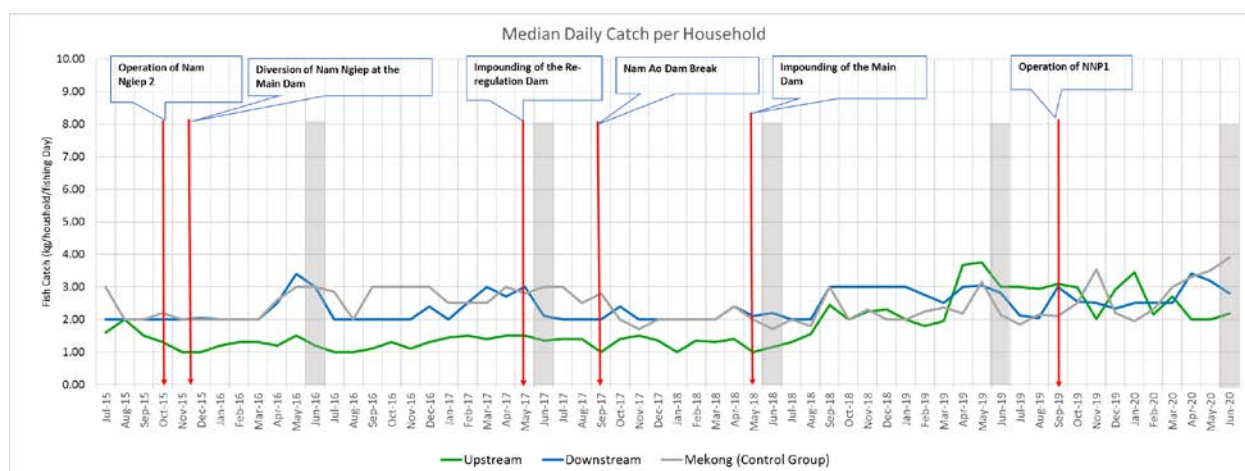
**TABLE 4-4: MEDIAN MONTHLY HOUSEHOLD FISH CATCH IN THE UPSTREAM AND DOWNSTREAM COMMUNITIES EXCLUDING ZONE 2LR FOR THE MONTH OF JUNE FROM 2016 TO 2020**

Fishing Zone	June 2016 (kg)	June 2017 (kg)	June 2018 (kg)	June 2019 (kg)	June 2020 (kg)
Upstream	8.1	8.3	4.1	38.6	28.0
Downstream	15.2	23.0	11.9	24.1	36.0

Fishing Zone	June 2016 (kg)	June 2017 (kg)	June 2018 (kg)	June 2019 (kg)	June 2020 (kg)
Mekong Control Group	21.1	20.4	12.2	45.9	66.9

The median daily fish catch per household are displayed in **Figure 4-5**, and the median fish catch per household per fishing day for the month of June from 2016 to 2020 are shown in **Table 4-5**.

**FIGURE 4-5: MEDIAN DAILY FISH CATCH PER HOUSEHOLD**



**TABLE 4-5: MEDIAN DAILY FISH CATCH PER HOUSEHOLD FOR THE MONTH OF JUNE FROM 2016 TO 2020**

Fishing Zone	June 2016 (kg)	June 2017 (kg)	June 2018 (kg)	June 2019 (kg)	June 2020 (kg)
Upstream	1.20	1.35	1.15	3.00	2.18
Downstream	3.00	2.10	2.20	2.81	2.80
Mekong (Control Group)	3.00	3.00	1.70	2.14	3.90

# **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	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG 05	NNG 06	NNG 07	NNG 08
Date	Parameters (Unit)	Guideline												
1-Jul-20	pH	5.0 - 9.0						6.2	6.19	6.23	6.16	6.69	6.62	6.9
2-Jul-20	pH	5.0 - 9.0		6.97	6.95	7.3	6.89							
6-Jul-20	pH	5.0 - 9.0	7.65											
7-Jul-20	pH	5.0 - 9.0		7.22	8.01	6.56								
8-Jul-20	pH	5.0 - 9.0					6.64	7.19						
9-Jul-20	pH	5.0 - 9.0							7.05	7.07	7.13	7.62	7.41	7.36
14-Jul-20	pH	5.0 - 9.0		8.36	8.57	8.24	7.39							
15-Jul-20	pH	5.0 - 9.0						7.83	7.47	7.47	7.42	7.82	7.84	7.97
22-Jul-20	pH	5.0 - 9.0		7.66	7.87	8.43	7.28							
23-Jul-20	pH	5.0 - 9.0						6.6	7.04	7.06	6.94	7.27	7.46	7.58
27-Jul-20	pH	5.0 - 9.0	7.52											
28-Jul-20	pH	5.0 - 9.0					8.15							
29-Jul-20	pH	5.0 - 9.0		8.52	8.26	8.52		8.07						
30-Jul-20	pH	5.0 - 9.0							6.46	6.57	7.31	7.91	7.76	7.9
1-Jul-20	Sat. DO (%)							93	18.2	15.9	45.1	51.9	55.6	71.8
2-Jul-20	Sat. DO (%)			96	106	102	101.2							
6-Jul-20	Sat. DO (%)		99.5											
7-Jul-20	Sat. DO (%)			96	116.3	110.4								
8-Jul-20	Sat. DO (%)						88.5	85.6						
9-Jul-20	Sat. DO (%)								38.5	23.2	46.2	45.8	63.2	74
14-Jul-20	Sat. DO (%)			97.2	117.6	110.2	101.4							
15-Jul-20	Sat. DO (%)							112.1	29.2	31.9	47.5	50.8	69.2	82.3
22-Jul-20	Sat. DO (%)			87.3	97.7	99.5	88.8							
23-Jul-20	Sat. DO (%)							89	31.7	32.8	50.5	53.4	62.8	66.9
27-Jul-20	Sat. DO (%)		113											
28-Jul-20	Sat. DO (%)						97.7							
29-Jul-20	Sat. DO (%)			96.1	84.2	105.1		105.7						
30-Jul-20	Sat. DO (%)								46.9	47.7	50.4	50	65.5	78.9
1-Jul-20	DO (mg/L)	>6.0						7.08	1.48	1.3	3.62	4.15	4.41	5.72

		River Name	Nam Ngiep											
		Zone	Location Refer to Construction Sites											
			Upstream/Main Reservoir						Within / Re-regulation Reservoir		Downstream			
		Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG 05	NNG 06	NNG 07	NNG 08
Date	Parameters (Unit)	Guidelin e												
2-Jul-20	DO (mg/L)	>6.0		7.54	7.89	7.58	7.56							
6-Jul-20	DO (mg/L)	>6.0	7.13											
7-Jul-20	DO (mg/L)	>6.0		7.62	8.66	8.23								
8-Jul-20	DO (mg/L)	>6.0					6.61	6.51						
9-Jul-20	DO (mg/L)	>6.0							3.13	1.89	3.72	3.71	5.02	5.86
14-Jul-20	DO (mg/L)	>6.0		7.72	8.76	8.22	7.6							
15-Jul-20	DO (mg/L)	>6.0						8.49	2.36	2.63	3.78	4.05	5.43	6.43
22-Jul-20	DO (mg/L)	>6.0		6.72	7.06	7.25	6.6							
23-Jul-20	DO (mg/L)	>6.0						6.77	2.56	2.68	3.98	4.25	4.91	5.18
27-Jul-20	DO (mg/L)	>6.0	8.39											
28-Jul-20	DO (mg/L)	>6.0					7.19							
29-Jul-20	DO (mg/L)	>6.0		7.55	6.16	7.69		7.72						
30-Jul-20	DO (mg/L)	>6.0							3.71	3.76	3.92	3.9	5.03	6.09
1-Jul-20	Conductivity (µs/cm)							71	90	89	86	88	78	70
2-Jul-20	Conductivity (µs/cm)			83	92	76	74							
6-Jul-20	Conductivity (µs/cm)		70.8											
7-Jul-20	Conductivity (µs/cm)			73	87	78								
8-Jul-20	Conductivity (µs/cm)						73	69						
9-Jul-20	Conductivity (µs/cm)								81	78	77	78	68	59
14-Jul-20	Conductivity (µs/cm)			85	82	75	73							
15-Jul-20	Conductivity (µs/cm)							70	86	84	84	84	76	70
22-Jul-20	Conductivity (µs/cm)			78	81	70	67							
23-Jul-20	Conductivity (µs/cm)							64	76	76	77	75	71	60
27-Jul-20	Conductivity (µs/cm)		101											
28-Jul-20	Conductivity (µs/cm)						68							
29-Jul-20	Conductivity (µs/cm)			77	85	71		65						
30-Jul-20	Conductivity (µs/cm)								74	76	76	78	71	62
1-Jul-20	Temperature (°C)							29.71	25.67	25.66	26.6	27.2	27.11	27.2



		River Name	Nam Ngiep											
		Zone	Location Refer to Construction Sites											
			Upstream/Main Reservoir						Within / Re-regulation Reservoir		Downstream			
		Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG 05	NNG 06	NNG 07	NNG 08
Date	Parameters (Unit)	Guideline												
2-Jul-20	Temperature (°C)			27.9	30.94	31.14	30.67							
6-Jul-20	Temperature (°C)		30.1											
7-Jul-20	Temperature (°C)			27.3	30.76	30.86								
8-Jul-20	Temperature (°C)						30.73	29.68						
9-Jul-20	Temperature (°C)								25.82	26.03	26.55	26.44	27.02	27.42
14-Jul-20	Temperature (°C)			27.8	30.75	30.72	30.42							
15-Jul-20	Temperature (°C)							29.79	26.1	26.04	26.98	27.07	27.91	28.24
22-Jul-20	Temperature (°C)			28.9	32.14	32.03	31.09							
23-Jul-20	Temperature (°C)							29.69	26.31	26.32	27.34	27.36	28.08	28.7
27-Jul-20	Temperature (°C)		28											
28-Jul-20	Temperature (°C)						31.22							
29-Jul-20	Temperature (°C)			27.7	31.9	31.77		31.85						
30-Jul-20	Temperature (°C)								27.47	27.59	28.26	28.25	29.04	28.88
1-Jul-20	Turbidity (NTU)							1.96	2.33	3.65	4.7	22.4	7.36	10.59
2-Jul-20	Turbidity (NTU)			133	8.34	1.97	1.92							
6-Jul-20	Turbidity (NTU)		32.9											
7-Jul-20	Turbidity (NTU)			44.3	3.1	3.59								
7-Jul-20	Turbidity (NTU)-hypolimnion					2.41								
8-Jul-20	Turbidity (NTU)						2.39	2.39						
8-Jul-20	Turbidity (NTU)-hypolimnion						2.63	4.54						
9-Jul-20	Turbidity (NTU)								3.17	3.43	3.55	6.3	7.07	10.09
14-Jul-20	Turbidity (NTU)			29.8	2.95	2.09	2.26							
15-Jul-20	Turbidity (NTU)							2.57	2.22	2.88	2.82	3.88	5.14	6.47
22-Jul-20	Turbidity (NTU)			30.8	5.08	2.97	2.36							
23-Jul-20	Turbidity (NTU)							2.36	4.16	2.64	2.94	5.97	12.46	7.11
27-Jul-20	Turbidity (NTU)		6.73											

		River Name	Nam Ngiep											
		Zone	Location Refer to Construction Sites											
			Upstream/Main Reservoir						Within / Re-regulation Reservoir		Downstream			
		Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG 05	NNG 06	NNG 07	NNG 08
Date	Parameters (Unit)	Guidelin e												
28-Jul-20	Turbidity (NTU)						2.21							
29-Jul-20	Turbidity (NTU)			171	6.19	2.6		2.23						
30-Jul-20	Turbidity (NTU)								2.75	2.75	3.01	3.89	4.96	8.3
6-Jul-20	TSS (mg/L)		71.8											
7-Jul-20	TSS (mg/L)			139		<5								
7-Jul-20	TSS (mg/L)-hypolimnion					25.14								
8-Jul-20	TSS (mg/L)						<5	<5						
8-Jul-20	TSS (mg/L)-hypolimnion						11.01	9.48						
9-Jul-20	TSS (mg/L)								<5	<5	<5	6.35	11.59	16.29
6-Jul-20	BOD <sub>5</sub> (mg/L)	<1.5	<1											
7-Jul-20	BOD <sub>5</sub> (mg/L)	<1.5		<1		<1								
7-Jul-20	BOD <sub>5</sub> (mg/L)-hypolimnion	<1.5				10.78								
8-Jul-20	BOD <sub>5</sub> (mg/L)	<1.5					<1	<1						
8-Jul-20	BOD <sub>5</sub> (mg/L)-hypolimnion	<1.5					10.84	7.14						
9-Jul-20	BOD <sub>5</sub> (mg/L)	<1.5							8.86	7.32	3.81	<1	<1	<1
6-Jul-20	Faecal coliform (MPN/100 mL)	<1,000	540											
7-Jul-20	Faecal coliform (MPN/100 mL)	<1,000		1,600		0								
7-Jul-20	Faecal coliform (MPN/100 mL)-hypolimnion	<1,000				4								
8-Jul-20	Faecal coliform (MPN/100 mL)	<1,000					17	8						
8-Jul-20	Faecal coliform (MPN/100 mL)-hypolimnion	<1,000					0	7.8						
9-Jul-20	Faecal coliform (MPN/100 mL)	<1,000							8	17	33	130	79	94
6-Jul-20	Total Coliform (MPN/100 mL)	<5,000	1,600											
7-Jul-20	Total Coliform (MPN/100 mL)	<5,000		1,600		5								
7-Jul-20	Total Coliform (MPN/100 mL)-hypolimnion	<5,000				34								

		River Name	Nam Ngiep											
		Zone	Location Refer to Construction Sites											
			Upstream/Main Reservoir						Within / Re-regulation Reservoir		Downstream			
		Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG 05	NNG 06	NNG 07	NNG 08
Date	Parameters (Unit)	Guidelin e												
8-Jul-20	Total Coliform (MPN/100 mL)	<5,000					1,600	920						
8-Jul-20	Total Coliform (MPN/100 mL)-hypolimnion	<5,000					17	13						
9-Jul-20	Total Coliform (MPN/100 mL)	<5,000							1,600	920	1,600	920	920	1,600

**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				
1-Jul-20	pH	5.0 - 9.0			6.5	6.59
2-Jul-20	pH	5.0 - 9.0		7.03		
6-Jul-20	pH	5.0 - 9.0	7.91			
7-Jul-20	pH	5.0 - 9.0		8.03		
9-Jul-20	pH	5.0 - 9.0			7.55	7.52
14-Jul-20	pH	5.0 - 9.0		8.3		
15-Jul-20	pH	5.0 - 9.0			7.66	7.8
22-Jul-20	pH	5.0 - 9.0		7.68		
23-Jul-20	pH	5.0 - 9.0			7.25	7.46
27-Jul-20	pH	5.0 - 9.0	6.85			
29-Jul-20	pH	5.0 - 9.0		8.2		
30-Jul-20	pH	5.0 - 9.0			7.72	7.85
1-Jul-20	Sat. DO (%)				89.7	88.3
2-Jul-20	Sat. DO (%)			101		
6-Jul-20	Sat. DO (%)		105.9			
7-Jul-20	Sat. DO (%)			104.8		
9-Jul-20	Sat. DO (%)				94.6	92.7
14-Jul-20	Sat. DO (%)			103.5		
15-Jul-20	Sat. DO (%)				93.3	94.4
22-Jul-20	Sat. DO (%)			92		
23-Jul-20	Sat. DO (%)				75.6	81.3
27-Jul-20	Sat. DO (%)		1.3.4			
29-Jul-20	Sat. DO (%)			102.6		
30-Jul-20	Sat. DO (%)				80.2	87.3
1-Jul-20	DO (mg/L)	>6.0			6.9	6.98
2-Jul-20	DO (mg/L)	>6.0		8.4		
6-Jul-20	DO (mg/L)	>6.0	8.11			
7-Jul-20	DO (mg/L)	>6.0		8.8		
9-Jul-20	DO (mg/L)	>6.0			7.41	7.47
14-Jul-20	DO (mg/L)	>6.0		8.73		
15-Jul-20	DO (mg/L)	>6.0			7.11	7.51
22-Jul-20	DO (mg/L)	>6.0		7.54		
23-Jul-20	DO (mg/L)	>6.0			5.66	6.42
27-Jul-20	DO (mg/L)	>6.0	7.83			
29-Jul-20	DO (mg/L)	>6.0		8.61		
30-Jul-20	DO (mg/L)	>6.0			6.05	6.75
1-Jul-20	Conductivity (µs/cm)				98	21
2-Jul-20	Conductivity (µs/cm)			76		
6-Jul-20	Conductivity (µs/cm)		22.5			
7-Jul-20	Conductivity (µs/cm)			77		
9-Jul-20	Conductivity (µs/cm)				82	17
14-Jul-20	Conductivity (µs/cm)			75		

		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				
15-Jul-20	Conductivity (µs/cm)				96	19
22-Jul-20	Conductivity (µs/cm)			69		
23-Jul-20	Conductivity (µs/cm)				100	19
27-Jul-20	Conductivity (µs/cm)		119.5			
29-Jul-20	Conductivity (µs/cm)			67		
30-Jul-20	Conductivity (µs/cm)				112	25
1-Jul-20	Temperature (°C)				28.97	27.47
2-Jul-20	Temperature (°C)			24.86		
6-Jul-20	Temperature (°C)		26.2			
7-Jul-20	Temperature (°C)			24.15		
9-Jul-20	Temperature (°C)				27.88	26.25
14-Jul-20	Temperature (°C)			24.01		
15-Jul-20	Temperature (°C)				29.38	26.98
22-Jul-20	Temperature (°C)			25.31		
23-Jul-20	Temperature (°C)				30.34	27.38
27-Jul-20	Temperature (°C)		26.8			
29-Jul-20	Temperature (°C)			24.29		
30-Jul-20	Temperature (°C)				30.13	28.65
1-Jul-20	Turbidity (NTU)				71.37	8.05
2-Jul-20	Turbidity (NTU)			44.18		
6-Jul-20	Turbidity (NTU)		12.56			
7-Jul-20	Turbidity (NTU)			12.29		
9-Jul-20	Turbidity (NTU)				28.83	5.48
14-Jul-20	Turbidity (NTU)			9.98		
15-Jul-20	Turbidity (NTU)				16.18	3.77
22-Jul-20	Turbidity (NTU)			948		
23-Jul-20	Turbidity (NTU)				19.56	10.69
27-Jul-20	Turbidity (NTU)		4.69			
29-Jul-20	Turbidity (NTU)			114		
30-Jul-20	Turbidity (NTU)				9.84	4.03
6-Jul-20	TSS (mg/L)		17.36			
7-Jul-20	TSS (mg/L)			22.65		
9-Jul-20	TSS (mg/L)				38.29	6.55
6-Jul-20	BOD <sub>5</sub> (mg/L)	<1.5	<1			
7-Jul-20	BOD <sub>5</sub> (mg/L)	<1.5		<1		
9-Jul-20	BOD <sub>5</sub> (mg/L)	<1.5			<1	<1
6-Jul-20	Faecal coliform (MPN/100 mL)	<1,000	1,600			
7-Jul-20	Faecal coliform (MPN/100 mL)	<1,000		540		
9-Jul-20	Faecal coliform (MPN/100 mL)	<1,000			540	350
6-Jul-20	Total Coliform (MPN/100 mL)	<5,000	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				
7-Jul-20	Total Coliform (MPN/100 mL)	<5,000		1,600		
9-Jul-20	Total Coliform (MPN/100 mL)	<5,000			1,600	1,600

## ANNEX B: RESULTS OF EFFLUENT ANALYSES

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

	Site Name	OSOV1 (Owner's Site Office and Village)		OSOV2 (ESD Camp)		Main Powerhouse	
	Station Code	EF01		EF13		EF19	
	Date	03-Jul-20	21-Jul-20	03-Jul-20	22-Jul-20	03-Jul-20	22-Jul-20
Parameters (Unit)	Guideline						
pH	6.0 - 9.0	5.99	7.55	7.45	6.14	8.13	
Sat. DO (%)		36.5	50	22	58.7	82.9	
DO (mg/L)		2.73	5.0	1.71	4.1	6.55	
Conductivity (µs/cm)		225	273	291	314	571	
TDS (mg/L)		112.5	137	146	157	286	
Temperature (°C)		28.3	29.8	26.6	31.6	29.57	
Turbidity (NTU)		2.12	2.54	9.36	13.9	7.58	
TSS (mg/L)	<50	<5	<5	10.2	34.2	67.0	No effluent discharged
BOD <sub>5</sub> (mg/L)	<30	<6	<6	14.04	20	<6	
COD (mg/L)	<125	n/a	n/a	n/a	n/a	n/a	
NH <sub>3</sub> -N (mg/L)	<10.0	n/a	n/a	n/a	n/a	n/a	
Total Nitrogen (mg/L)	<10.0	n/a	n/a	n/a	n/a	n/a	
Total Phosphorus (mg/L)	<2	n/a	n/a	n/a	n/a	n/a	
Oil & Grease (mg/L)	<10.0	n/a	n/a	n/a	n/a	n/a	
Total coliform (MPN/100 mL)	<400	920	350	16,000	20,000	79	
Faecal Coliform (MPN/100 mL)	<400	540	350	16,000	20,000	0	
Effluent Discharge Volume (L/mn)		6	6	3	4	900	
Chlorination Dosing Rate (mL/mn)		n/a	n/a	15	51	250	
Residual Chlorine (mg/L)	<1.0	n/a	n/a	0.4	0.0	1.19	