







**NAM NGIEP 1**  
POWER COMPANY

## Nam Ngiep 1 Hydropower Project

# Environmental Management Monthly Monitoring Report

November 2020

					
					
A	25 December 2020	Hendra WINASTU Khamtone SAYSOMPHOU	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 (EGAT OM) .....	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>
<b>3. ENVIRONMENTAL MANAGEMENT MONITORING .....</b>	<b>21</b>
3.1 ENVIRONMENTAL MANAGEMENT SYSTEM (EMS) .....	21
3.2 COMPLIANCE MANAGEMENT .....	22
3.2.1 <i>Site Inspection by Environment Management Unit.....</i>	<i>23</i>
3.2.2 <i>Site Decommissioning and Rehabilitation .....</i>	<i>23</i>
3.3 ENVIRONMENTAL QUALITY MONITORING.....	24
3.3.1 <i>Effluent Discharge from Camps and Construction Sites .....</i>	<i>24</i>
3.3.2 <i>Ambient Surface Water Quality Monitoring.....</i>	<i>25</i>
3.3.3 <i>Groundwater Quality Monitoring.....</i>	<i>29</i>
3.3.4 <i>Gravity Fed Water Supply (GFWS) Quality Monitoring .....</i>	<i>30</i>
3.3.5 <i>Landfill Leachate Monitoring.....</i>	<i>31</i>
3.3.6 <i>Discharge Monitoring .....</i>	<i>31</i>
3.3.6.1 <i>Main Reservoir – Water Level, Inflow and Discharge .....</i>	<i>31</i>
3.3.6.2 <i>Re-regulation Reservoir – Discharge.....</i>	<i>32</i>
3.3.7 <i>Nam Ngiep Downstream Water Depth Monitoring .....</i>	<i>33</i>
3.4 PROJECT WASTE MANAGEMENT .....	33
3.4.1 <i>Solid Waste Management .....</i>	<i>33</i>
3.4.2 <i>Hazardous Materials and Waste Management .....</i>	<i>34</i>
3.5 COMMUNITY WASTE MANAGEMENT .....	35
3.5.1 <i>Community Recycling Programme .....</i>	<i>35</i>
3.5.2 <i>Community Solid Waste Management.....</i>	<i>35</i>
3.6 WATERSHED AND BIODIVERSITY MANAGEMENT .....	36
3.6.1 <i>Watershed Management .....</i>	<i>36</i>

3.6.2 Biodiversity Offset Management.....	39
3.7 FLOATING DEBRIS REMOVAL.....	42
<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>56</b>

## TABLE OF TABLES

<i>Table 2-1: Summary of The Main dam operation in November 2020.....</i>	<b>13</b>
<i>Table 2-2 : Summary of Main power station in November 2020.....</i>	<b>13</b>
<i>Table 2-3 : Energy amount in November 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 November 2020.....</i>	<b>15</b>
<i>Table 2-6: Summary of Re-regulation Power Station in November 2020 .....</i>	<b>15</b>
<i>Table 2-7: Energy Amount in November 2020 (Re-regulation Power Station) .....</i>	<b>16</b>
<i>Table 2-8: Unavailability and Significant Event in November 2020 (Main Power Station)..</i>	<b>17</b>
<i>Table 2-9: Liquidated Damage in November 2020 (Main Power Station).....</i>	<b>18</b>
<i>Table 2-10: Unavailability and Significant Event in November 2020 (Re-regulation Power Station).....</i>	<b>18</b>
<i>Table 2-11: Maintenance Activity.....</i>	<b>18</b>
<i>Table 3-1: Environmental Management System Work Plan .....</i>	<b>21</b>
<i>Table 3-2: SS-ESMMP and Document Review Status in November 2020.....</i>	<b>22</b>
<i>Table 3-3: Summary of ONCs and NCRs .....</i>	<b>22</b>
<i>Table 3-4: Summary of the ONCs and NCRs that are Unsolved Exceeding Deadlines.....</i>	<b>22</b>
<i>Table 3-5: Revegetation and Defect Corrections .....</i>	<b>24</b>
<i>Table 3-6: Status of Corrective Actions for Non-Compliances at WWTSS in November 2020</i>	<b>25</b>
<i>Table 3-7: Results of Surface Water Quality Monitoring for Dissolved Oxygen (mg/L) in the upper 0.2 m, National Water Quality Standard: &gt;6.0 mg/L.....</i>	<b>28</b>
<i>Table 3-8: Results of Surface Water Quality Monitoring for Total Suspended Solids (mg/L)</i>	<b>28</b>
<i>Table 3-9: Results of Surface Water Quality Monitoring for BOD5 (mg/L) - Water Quality Standard: &lt; 1.5 mg/L.....</i>	<b>29</b>
<i>Table 3-10: Groundwater Quality Monitoring Results in Somsuen, Nam Pa, ThongNoy and Pou Villages .....</i>	<b>29</b>
<i>Table 3-11: Results of the Gravity Fed Water Supply Quality Monitoring .....</i>	<b>30</b>
<i>Table 3-12: Results of the Landfill Leachate Monitoring .....</i>	<b>31</b>
<i>Table 3-13: Amounts of Recyclable Waste Sold.....</i>	<b>34</b>

<b>Table 3-14: Record of Hazardous Material Inventory.....</b>	<b>34</b>
<b>Table 3-15: Record of Hazardous Waste Inventory .....</b>	<b>34</b>
<b>Table 3-16: Types and Amounts of Recyclable Waste Traded at the Community Recycle Waste Bank .....</b>	<b>35</b>
<b>Table 4-1: Fish Species dominating the Fish Catch in October 2020 .....</b>	<b>43</b>
<b>Table 4-2: Threatened Species of October 2020 Fish Catch.....</b>	<b>43</b>
<b>Table 4-3: Total Fish Catch by Upstream (Excluding Zone 2LR), Downstream and Mekong Control Group Fishing Households for the month of October from 2015 to 2020.....</b>	<b>44</b>
<b>Table 4-4: Median Monthly Household Fish Catch in the Upstream and Downstream Communities Excluding Zone 2LR for the month of October from 2015 to 2020.....</b>	<b>46</b>
<b>Table 4-5: Median Daily Fish Catch per Household for the month of October from 2015 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: Monthly Rainfall at Thavieng .....</b>	<b>17</b>
<b>Figure 2-7: Reservoir of the Main Dam.....</b>	<b>18</b>
<b>Figure 2-8: Reservoir of the Re-Regulation Dam .....</b>	<b>18</b>
<b>Figure 2-9: Re-vegetation of RCC Plant Yard.....</b>	<b>19</b>
<b>Figure 2-10: Re-vegetation of CVC Plant Yard.....</b>	<b>19</b>
<b>Figure 2-11: Quarry Area View Showing Re-Vegetation and Safety Fence Installation .....</b>	<b>19</b>
<b>Figure 2-12: Phase 2 of Project Landfill Development on 08 June 2017.....</b>	<b>20</b>
<b>Figure 2-13: Schedule of Significant Remaining Works in 2020 .....</b>	<b>20</b>
<b>Figure 3-1: Surface Water and Re-Regulation Reservoir Water Quality Monitoring Stations.....</b>	<b>27</b>
<b>Figure 3-2: Concentration of Dissolved Oxygen (mg/L) in the upper 0.2 m since September 2019 to November 2020 .....</b>	<b>28</b>
<b>Figure 3-3: Water Level, Inflow and Discharge for the Main Reservoir .....</b>	<b>32</b>
<b>Figure 3-4: Discharge Monitoring at the Re-regulation Dam in September to November 2020 .....</b>	<b>33</b>

<b>Figure 3-5: Waste management activities during November 2020 .....</b>	<b>36</b>
<b>Figure 3-6 : Photos during the Water Safety Training 03-05 November 2020 (first aid, victim management and rescue, swimming technique) .....</b>	<b>37</b>
<b>Figure 3-7 : Photos during the Water Safety Training 03-05 November 2020 (boat operation and safety working in the water).....</b>	<b>38</b>
<b>Figure 3-8: Map of Threats Recorded by Patrolling Teams in October 2020 .....</b>	<b>40</b>
<b>Figure 3-9: Hunting camp found and destroyed by Team 1 .....</b>	<b>41</b>
<b>Figure 3-10: Fishing camp found and destroyed by Team 2 .....</b>	<b>41</b>
<b>Figure 3-11: Lines of snares found by Team 3 .....</b>	<b>41</b>
<b>Figure 3-12: Large wire snares collected and destroyed by Team 3 .....</b>	<b>41</b>
<b>Figure 3-13: Hunting camp found and destroyed by Team 4 .....</b>	<b>41</b>
<b>Figure 4-1: Total Monthly Fish Catch July 2015 – October 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 October from 2015 to 2020.....</b>	<b>45</b>
<b>Figure 4-3: Number of Fishing Households Involved in the Fish Catch Monitoring Programme .....</b>	<b>45</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
EC OCD	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

The top management of NNP1PC has announced the Company's Environmental and Social Policies to all NNP1PC staff on 17 November 2020 and the NNP1PC ISO Committee comprising of 12 staff from every section was officially nominated by the Managing Director (MD) on 18 November 2020. A service contract with SGS (Lao) Sole Co., Ltd. was signed for ISO 14001:2015 training and certification audit. The first online training on Requirements and Interpretation of ISO14001:2015 was completed on 30 November and 01 December 2020 (2 days), 21 NNP1PC staff participated. The two trainings on Risk Assessment and Documented Information are scheduled in December 2020 or January 2021.

During the month, Environmental Management Office (EMO) of NNP1PC received one Detailed Work Program (DWP) and Site Specific Environmental and Social Management and Monitoring Plan (SS-ESMMP) and one DWP and SS-ESMMP was carried over from last month for review and approval.

A total of 32 revegetation sites were monitored in November 2020, the percentage of vegetation cover has been maintained, but the green cover has decreased compared with the previous months due to less rain during the dry season.

In early November 2020, the study on wastewater treatment effectiveness and related technical review of the four wastewater treatment systems (WWTSs) were completed by a good cooperation between an external EMO Consultant, ADM, TD, SMO-INFRA and EMO team. The study report was shared to the management of ADM, TD and ESD for consideration and further discussion. In late November 2020, the related documents including the scope of work were proceeded for PCD to procure a qualified contractor to improve the WWTSs in OSOV1 and main dam as well as modify the WWTS in OSOV2.

During the month, Dissolved Oxygen (DO) levels at the surface of the main reservoir were generally between 5 and 8 mg/L. In the re-regulation reservoir, the DO levels were below 4 mg/L.

During November 2020, the discharge from the re-regulation dam mainly went through the turbine. The DO levels were less than 6 mg/L at the stations in Nam Ngiep immediately downstream of the Re-regulation Dam and thus were non-compliant with the GOL Standard. No dead fish was observed in Nam Ngiep downstream during this monitoring period. NNP1PC is in the process of collecting information to assist in developing measures to improve the DO levels downstream.

A total of 17.8 m<sup>3</sup> of solid waste was disposed of at the NNP1 Project Landfill, a decrease of 2.2 m<sup>3</sup> compared with October 2020. A total of 15.7 m<sup>3</sup> of solid waste from Phouhomxay, Thahuea and Hat Gniun Villages was disposed of at Houay Soup Landfill. A total 283 kg out of 579.5 kg of poor condition cardboard and 28.5 kg out of 63.5 kg of plastic bottles stored in the community waste bank had become unsellable and were disposed of at Houay Soup Landfill.

NNP1PC organized a three days water safety training in collaboration with Lao Red Cross on 03-05 November 2020. The reservoir patrolling of Bolikhamxay under the approved AIP2020 started on 12 November 2020 but it could not be completed as planned due to an issue with a boat engine. The fund for Xaysomboun WRPO under the approved AIP2020 could not be disbursed yet because of the process of changing the bank account from USD to LAK could not be completed until end of November 2020.

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

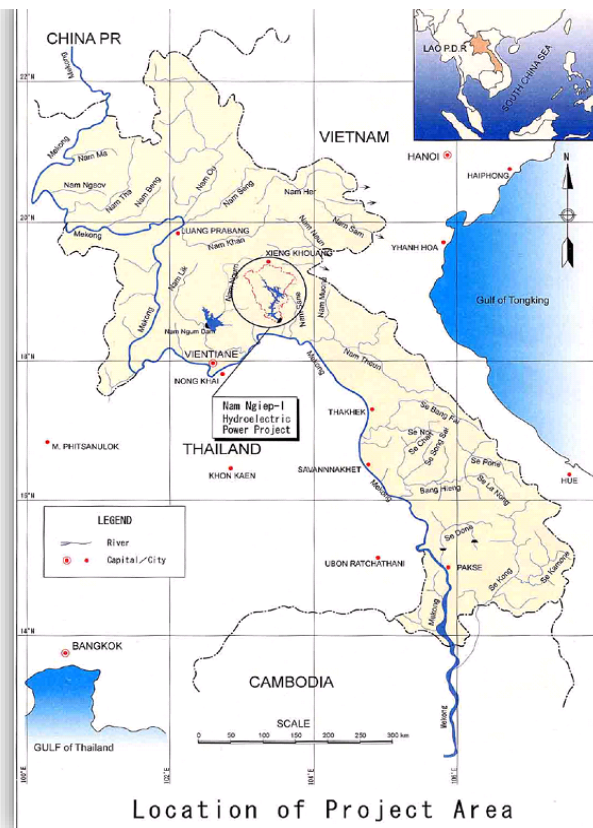
The fish catch monitoring for October 2020 in Nam Ngiep watershed was dominated by *Channa striata* and *Tor sinensis* and species groups of *Poropuntius*, *Hampala*, and *Barbonymus* and *Hypsibarbus* that are classified as Least Concern (LC) according to the IUCN Red List, except *Tor sinensis* is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

## 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 Bolikham 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 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.

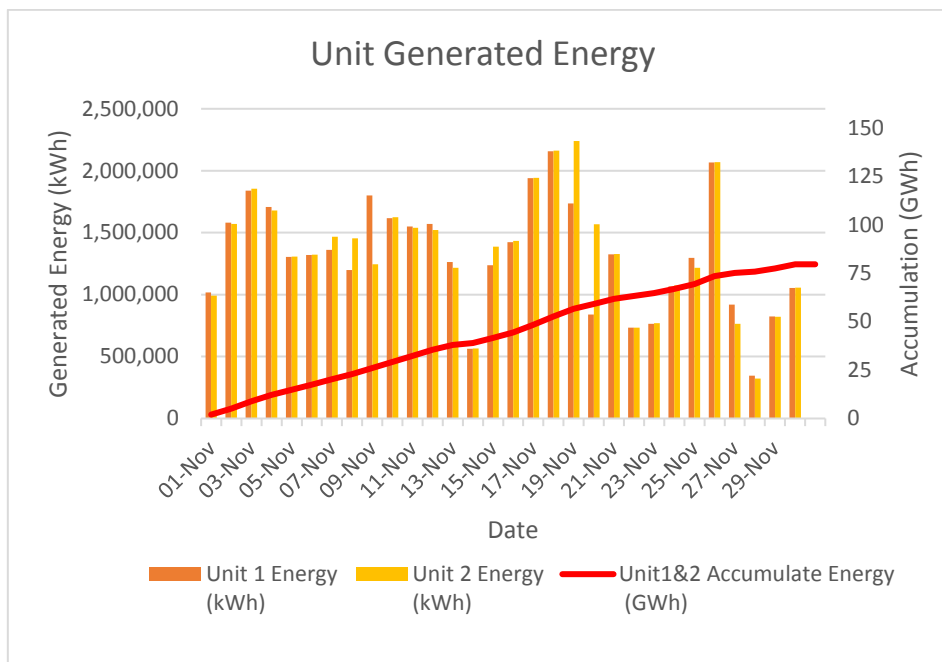
## 2.1 OPERATION AND POWER GENERATION

### 2.1.1 Power Production

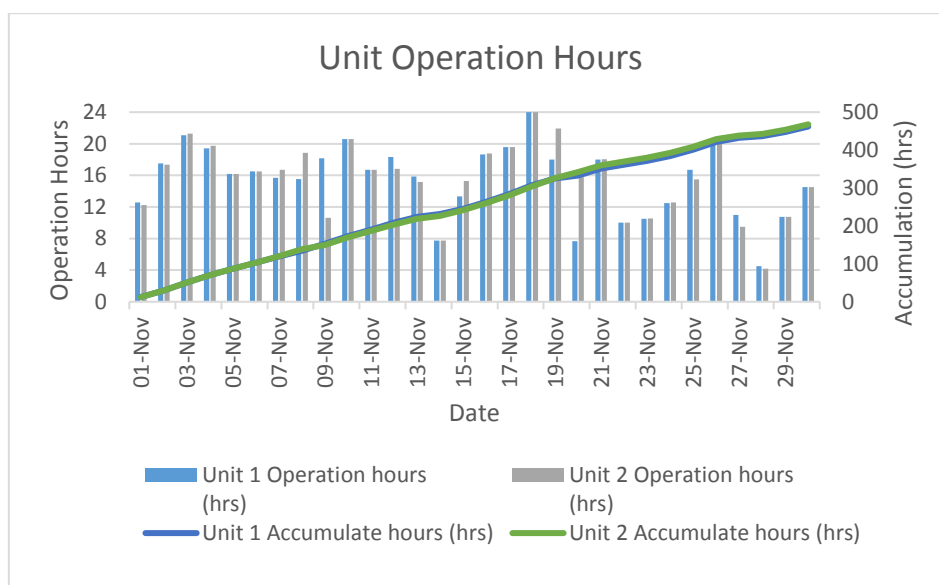
#### 2.1.1.1 Main Power Station

**Figure 2.1** and **Figure 2.2** shows the generation data at the main power station in November 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: SUMMARY OF THE MAIN DAM OPERATION IN NOVEMBER 2020**

Dam Data	Unit	Quantity
Main Dam water level at Beginning of the Month	m asl	315.10
Main Dam water level at End of the Month	m asl	314.09
Effective storage at Beginning of the Month	MCM	887.29
Effective storage at End of the Month	MCM	827.70
Inflow	MCM	194.70
Turbine discharge	MCM	257.54
Spillage (excluding riparian release)	MCM	0.0

**Table 2-2, 2-3 and 2-4** shows the generation data at the main power station. In September 2020, the Actual Generation (118.73GWh) was higher than the Aggregate Declaration (114.6GWh).

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

Power Station Data	Unit	Quantity	
Generated Energy	GWh	79.66	
Delivery Energy at Delivery Point	GWh	78.06	
Station Service Energy	kWh	199,985	
		Unit 1	Unit 2
Period of Operation	Hours	462:04	467:49
Planned Outage	Hours	0:0	9:00
Unplanned Outage	Hours	30:54	10:00
Number of Unit Starts	No.	50	53

**TABLE 2-3 : ENERGY AMOUNT IN NOVEMBER 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	109,458.8	94.6	226.6

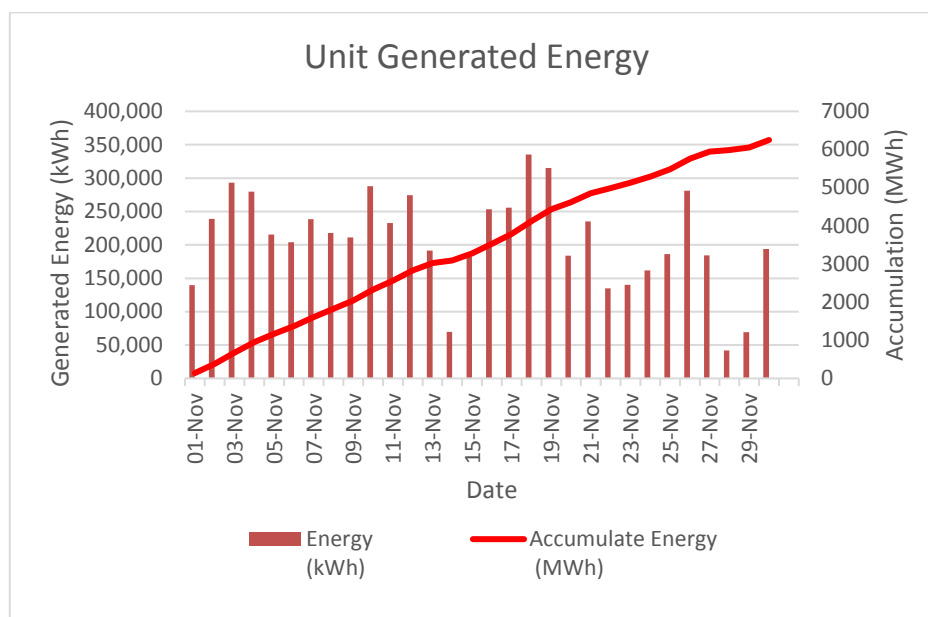
Month	Energy amount for the month (MWh)				Imported Energy (MWh)	Station Service Energy (MWh)
	Primary Energy	Secondary Energy	Excess Energy	Total		
August	81,332.5	41,485.7	0	122,808.2	110.1	213.6
September	108,465.0	0	0	108,465.0	83.7	216.3
October	113,510.0	806.0	0	114,316.0	82.7	223.4
November	101,288.5	0	0	101,288.5	110.4	200.0

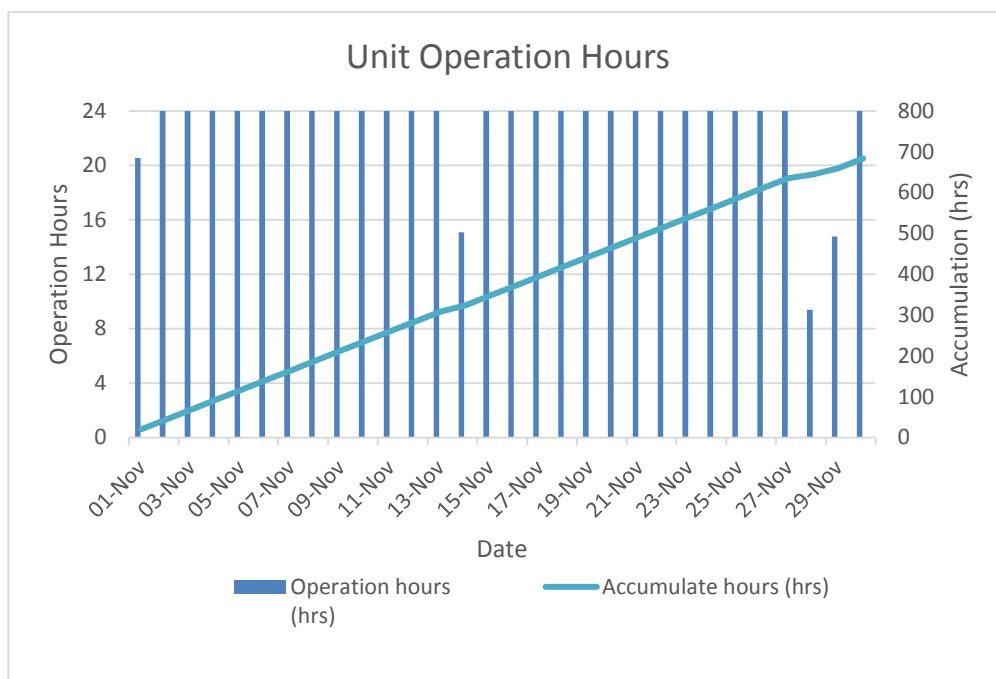
**TABLE 2-4 : DECLARATION (MAIN POWER STATION)**

Declaration	Unit	November 2020		December 2020 Aggregate Declaration
		Aggregate Declaration	Final Declaration	
Primary Energy	MWh	107,300	101,289	78,000
Secondary Energy	MWh	2,700	0	0
<b>Total</b>	<b>MWh</b>	<b>110,300</b>	<b>101,289</b>	<b>78,000</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 November 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 NOVEMBER 2020**

Dam Data	Unit	Quantity
Dam Water Level at Beginning of the Month	m asl	177.98
Dam water Level at End of the Month	m asl	177.11
Inflow	MCM	257.52
Turbine Discharge	MCM	230.96
Spillage	MCM	29.57

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

Power Station Data	Unit	Quantity
Generated energy	GWh	6.61
Delivery Energy at billing meter	GWh	6.25
Station service energy	kWh	73,118
Operation Hour	Hours	683:49
Planned outage	Hours	0
Unplanned outage	Hours	0:11
Number of unit start	No.	5

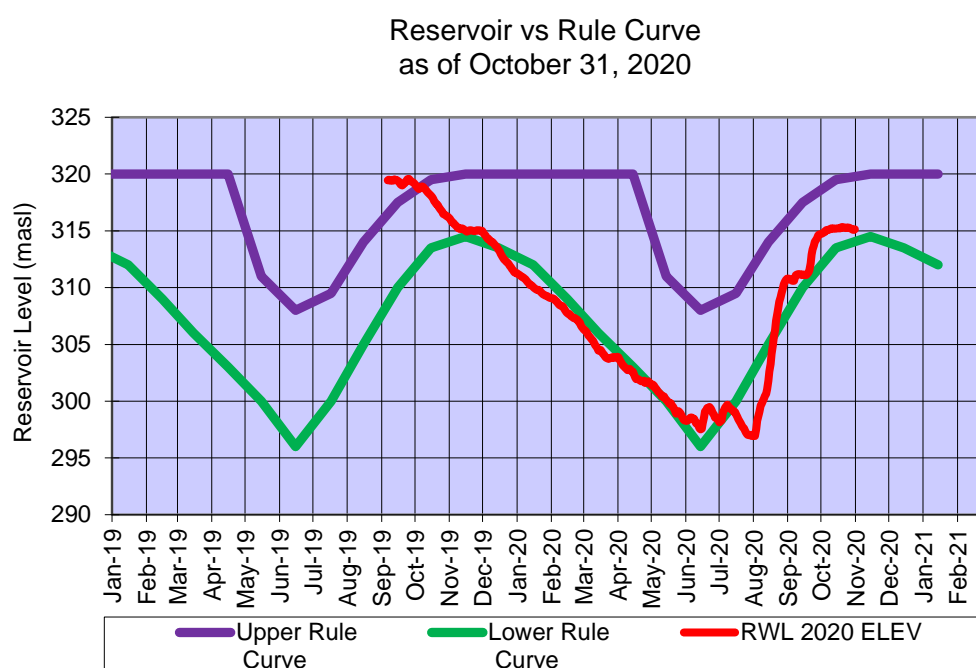
**TABLE 2-7: ENERGY AMOUNT IN NOVEMBER 2020 (RE-REGULATION POWER STATION)**

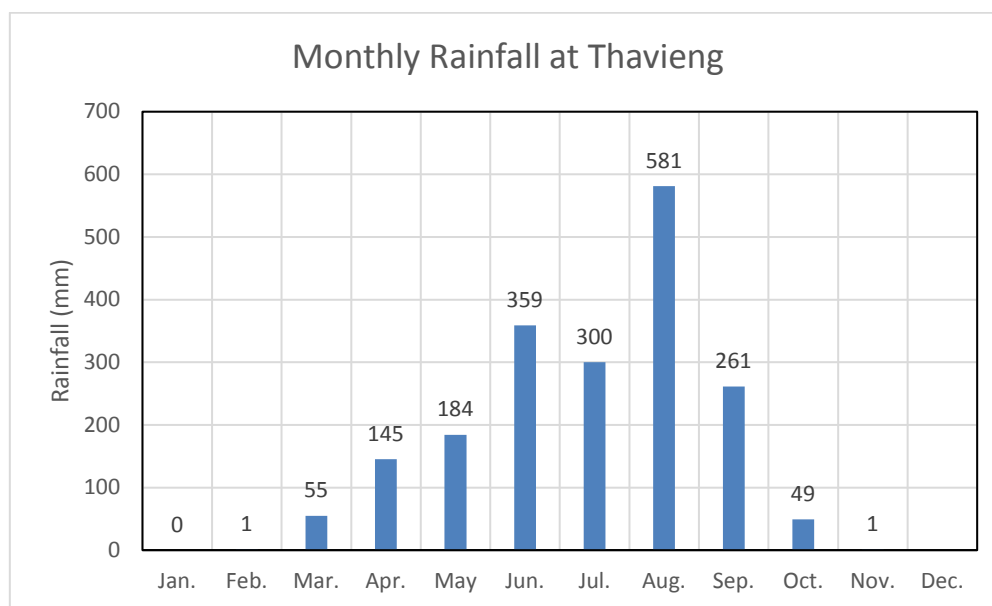
Month	Energy Amount for the Period (MWh)	Imported Energy (MWh)	Station Service Energy (MWh)
January	4,573	18.8	67.8
February	5,179	11.0	66.2
March	4,764	37.5	64.2
April	4,801	61.1	59.8
May	6,681	10.7	75.7
June	6,497	30.5	70.7
July	9,376	2.9	77.9
August	8,684	1.7	77.5
September	8,543	8.1	75.6
October	7,977	0.5	78.5
November	6,249	12.8	73.1

### 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 the inflow.

The water level was recovered by heavy rainfall in August 2020; however, it was lower than we expected at the end of November 2020.

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

**FIGURE 2-6: MONTHLY RAINFALL AT THAVIENG**

### 2.1.2 Outage, Liquidated Damages and Unavailability

**TABLE 2-8: UNAVAILABILITY AND SIGNIFICANT EVENT IN NOVEMBER 2020 (MAIN POWER STATION)**

Unit	Date/Time		Event	Outage Type	Period of Outage (Hours)
	Started	Finished			
1	7 Nov (01:10)	7 Nov (01:21)	Failure to meet AGC level	Forced Outage	00:11
	7 Nov (17:48)	7 Nov (18:41)	Shaft sealing water flow low due to mud	Forced Outage	00:53
	15 Nov (8:00)	15 Nov (18:00)	Regular cleaning cooling water system	Short Notice Outage	10:00
	19 Nov (18:00)	19 Nov (24:00)	Regular cleaning cooling water system	Short Notice Outage	6:00
	20 Nov (01:00)	20 Nov (12:40)	Regular cleaning cooling water system	Short Notice Outage	11:40
	30 Oct (09:00)	30 Oct (11:00)	Maintenance for 22kV DL	Short Notice Outage	2:00
2	15 Nov (8:00)	15 Nov (16:00)	Replacement of speed sensor	Short Notice Outage	8:00
	19 Nov (9:00)	19 Nov (11:00)	Cleaning of the flow sensor for lower oil cooler	Short Notice Outage	2:00
	29 Nov (08:00)	29 Nov (17:00)	Regular cleaning cooling water system	Planned Outage	9:00

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

<b>USD Portion</b>	<b>Baht Portion</b>
715.46	75,754.21

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

<b>Unit</b>	<b>Date/Time</b>		<b>Event</b>	<b>Outage Type</b>	<b>Period of Outage (Hours)</b>
	<b>Started</b>	<b>Finished</b>			
1	14 Nov (08:28)	14 Nov (08:39)	Cleaning water flow sensor	Forced Outage	0:11

## 2.2 MAINTENANCE WORK (EGAT OM)

**TABLE 2-11: MAINTENANCE ACTIVITY**

<b>Date</b>	<b>Activity</b>
15 November 2020	Main Power Station: Replacement of speed sensor for Unit2
19 November 2020	Main Power Station: Cleaning Cooling Water System of Unit1
29 November 2020	Main Power Station: Cleaning Cooling Water System of Unit2

## 2.3 CIVIL AND APPURTENANT STRUCTURE

### 2.3.1 Reservoir

**FIGURE 2-7: RESERVOIR OF THE MAIN DAM****FIGURE 2-8: RESERVOIR OF THE 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 2-9: RE-VEGETATION OF RCC PLANT YARD**



**FIGURE 2-10: 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 2-11: QUARRY AREA VIEW SHOWING RE-VEGETATION AND SAFETY FENCE INSTALLATION**



**AS OF 27 SEPTEMBER 2020**



**AS OF 6 NOVEMBER 2020**

### 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 2-12: PHASE 2 OF PROJECT LANDFILL DEVELOPMENT ON 08 JUNE 2017**

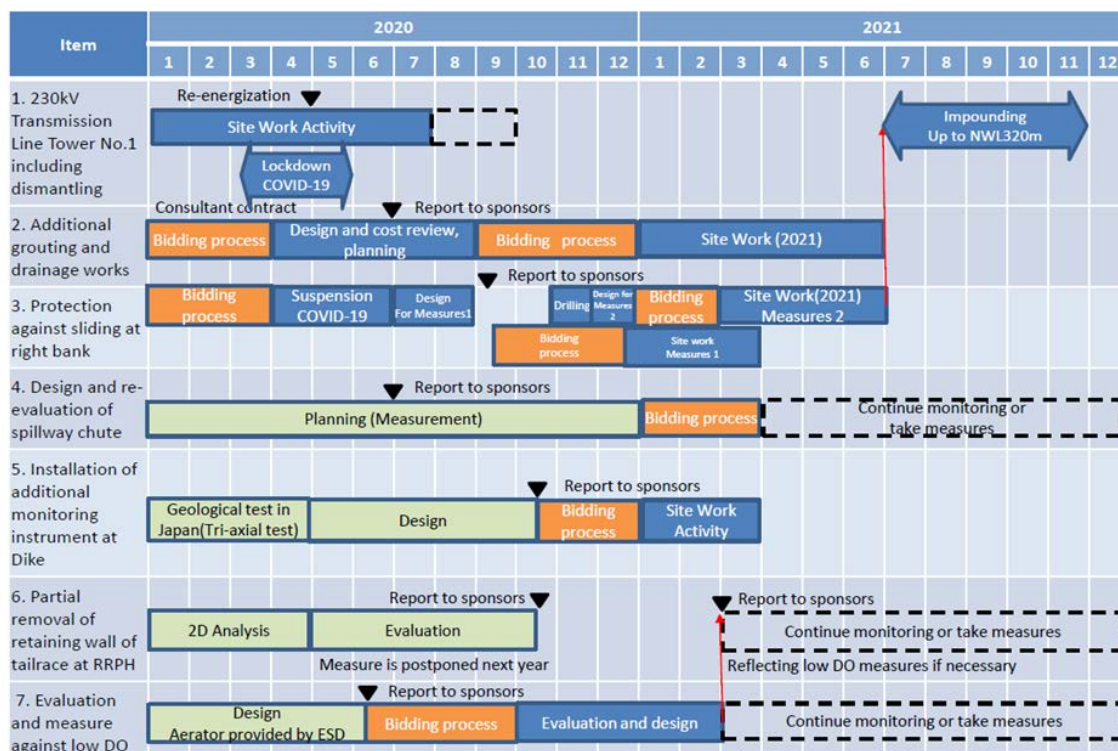
#### CURRENT CONDITION OF LANDFILL



### 2.3.2.3 Remaining Work

As shown in **Figure 2-13**, there remain seven items of significant works. Item number 1, 2, 3, and 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 2-13: SCHEDULE OF SIGNIFICANT REMAINING WORKS IN 2020**



### 3. ENVIRONMENTAL MANAGEMENT MONITORING

#### 3.1 ENVIRONMENTAL MANAGEMENT SYSTEM (EMS)

In parallel with the contract negotiations with the selected ISO14001 service provider, the top management of NNP1PC has announced the Company's Environmental and Social Policies to all NNP1PC staff on 17 November 2020 and the NNP1PC ISO Committee comprising of 12 staff in total representing all divisions was officially nominated by the Managing Director (MD) on 18 November 2020. The target is to obtain certification of compliance with ISO14001:2015 Environmental Management System Standard by September 2021.

A service contract with SGS (Lao) Sole Co., Ltd. was signed for ISO 14001:2015 training and certification audit. The first online training on Requirements and Interpretation of ISO14001:2015 was completed on 30 November and 01 December 2020 (2 days), 21 NNP1PC staff participated. The two trainings on Risk Assessment and Documented Information are scheduled in December 2020 or January 2021.

**TABLE 3-1: ENVIRONMENTAL MANAGEMENT SYSTEM WORK PLAN**

Item	ISO14001:2015 Work Plan	Year 2020		Year 2021			
		Q3	Q4	Q1	Q2	Q3	Q4
1	Continue to prepare EMS documents (8 Standard Operating Procedures are completed)						
2	<b>NNP1PC Environmental Policy announcement</b>						
3	NNP1PC ISO Committee establishment						
4	Training relevant staff on: - Requirement and Interpretation of ISO14001:2015 - Organization Context and Risk Management for ISO14001 - ISO14001:2015 Document Information - ISO14001:2015 Internal Audit						
5	Implement the EMS procedures and processes						
6	ISO14001:2015 Internal Audit						
7	Implement the corrective actions and preventive actions according to the Internal Audit						
8	Management Review by NNP1PC Management						
9	ISO 14001:2015 Assessment and Certification Audit – <b>1<sup>st</sup> Stage</b> ( <b>remote audit</b> on the documentation review)						
10	Implement the corrective actions and preventive actions according to the 1 <sup>st</sup> Stage Audit						
11	ISO 14001:2015 Assessment and Certification Audit – <b>2<sup>nd</sup> Stage</b> ( <b>on-site audit</b> )						
12	Implement the corrective actions and preventive actions according to the 2 <sup>nd</sup> Stage Audit						
13	<b>Certify of ISO14001:2015 upon successful completion of the audit</b>						

### 3.2 COMPLIANCE MANAGEMENT

In November 2020, EMO received one DWP and SS-ESMMP and one DWP and SS-ESMMP was carried over from last month for review and approval. The status is presented in **Table 3-2**.

**TABLE 3-2: SS-ESMMP AND DOCUMENT REVIEW STATUS IN NOVEMBER 2020**

Title	Date Received	Status
<b>DWP and SS-ESMMP for Geotechnical Investigation at the Main Dam Downstream Right Bank Slope Area</b>	30 October 2020 (2 <sup>nd</sup> submission)	No objection with comments on 04 November 2020. <i>(Unclear information of access roads construction and counter measures for turbid water from the drilling activity)</i>
<b>DWP and SS-ESMMP for Construction of Suspension Bridge in 2UR</b>	25 November 2020 (2 <sup>nd</sup> submission)	No objection with comments on 26 November 2020 for the SS-ESMMP part. <i>(DWP is pending approval by NNP1PC-TD and ESD INFRA)</i>

There were no Observations of Non-Compliance issued during November 2020. The status of compliance reports (Observation of Non-Compliance or ONC, Non-Compliance Report or NCR) issued by NNP1PC is summarized in **Error! Reference source not found.** and the status of the ONCs and NCRs that are unsolved exceeding deadlines are presented in **Table 3-4**.

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

Items	ONC	NCR-1	NCR-2	NCR-3
Carried over from October 2020	3	2	0	0
Newly Opened in November 2020	0	0	0	0
<b>Total in November 2020</b>	<b>3</b>	<b>2</b>	<b>0</b>	<b>0</b>
Resolved in November 2020	1	0	0	0
Carried over to December 2020	2	2	0	0
Unsolved Exceeding Deadlines	2	2	0	0

**TABLE 3-4: SUMMARY OF THE ONCs AND NCRs THAT ARE UNSOLVED EXCEEDING DEADLINES**

Document Number / Date of Issue	Subject Description	Current Status at the end of November 2020
ONC_AM-0003 / 28 Feb 2020	Issued to ADM to improve the second wetland pond similarly to the first wetland pond. (Based on the LTA's recommendation made during	NNP1PC and the WWTS Consultant have completed the conceptual report and proposal for WWTS improvement for management review and approval. EMO submitted a Document Approval Sheet (DAS) subjects on design and

Document Number / Date of Issue	Subject Description	Current Status at the end of November 2020
	the mission in August 2019 to improve the OSOV's WWTS)	improvement/modification of the WWTS to NNP1PC's Procurement to proceed with a bidding for the qualified contractor. It's expected to organize pre-bidding meeting by December 2020.
ONC_OC-0349 / 24 Mar 2020	Issued to instruct the OC Contractor to use only the approved tree species for revegetation and dead plant replacement.	The contractor is continuing routine inspection combined with revegetation and maintenance of perimeter fence as necessary. <b><i>The ONC will be closed by the end of the contractor's liability period (January 2021).</i></b>
NNP1-ESD-EMO-NCR-VSP-0001 / 13 Jul 2020 (NCR Level 1)	Non-Compliance with site rehabilitation at the Spoil Disposal Area for the construction of the irrigation canal	The site was partially covered with a thin green of sown RUZI grass seed germination. <b><i>The NCR1 will be closed when the revegetation has been successfully completed.</i></b>
NNP1-ESD-EMO-NCR-HM-0007 / 06 Apr 2020 (NCR Level 1)	Non-Compliance with the site revegetation requirements at HM Hydro's Labour Camp No.2 (LILAMA10 Camp).	The corrective action was completed on 08 September 2020 by HM Hydro Contractor. This revegetated site will be monitored by NNP1-EMO until the end of the rainy season 2020. The first joint site inspection and evaluation of the revegetation will be conducted three months after the date of re-vegetation completion. <b><i>The NCR1 will be closed when the revegetation has been successfully completed.</i></b>

### 3.2.1 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 November 2020.

NNP1PC has transferred the supporting fund to the GOL-MONRE of central, provincial and district level. EMO will coordinate with the EMU of Bolikhan District (Bolikhan DONRE) in organizing a joint site visit and inspection by December 2020.

### 3.2.2 Site Decommissioning and Rehabilitation

During November 2020, EMO continually monitored the revegetated sites for grass seed germination and vegetation cover as well as site stability. The percentage of vegetation-cover has generally been maintained at 23 out of a total of 32 sites, but the green cover has decreased compared with the previous months due to less rain during the dry season. As of 30 November 2020, few defect corrections (slope erosion at RCC Plant, dead tree replacement at AGG plant

and silt fence installation at spoil disposal area 8 and RT camp) observed during the second quarterly joint evaluation in September 2020 were completely resolved in accordance with NNP1PC's instructions.

The results of the corrective actions are shown in **Table 3-5**.

**TABLE 3-5: REVEGETATION AND DEFECT CORRECTIONS**



### 3.3 ENVIRONMENTAL QUALITY MONITORING

The analyses of Total Suspended Solids (TSS), Biochemical Oxygen Demand (BOD5), Faecal Coliform Bacteria, Total Coliform Bacteria and E.coli 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/>

#### 3.3.1 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 November 2020 indicated non-compliances for some parameters in OSOV2 (EF13) and the Main Powerhouse (EF19).

The status of implementation of the corrective actions addressing non-compliances at the camps and key project facilities are summarized in **Table 3-6**.

**TABLE 3-6: STATUS OF CORRECTIVE ACTIONS FOR NON-COMPLIANCES AT WWTSS IN NOVEMBER 2020**

Site	Sampling ID	Status	Corrective Actions
OSOV1	EF01	Fully compliance	<ul style="list-style-type: none"> <li>➤ In early November 2020, the study on wastewater treatment effectiveness and related technical review of the existing four WWTSSs were completed;</li> <li>➤ The study report was shared to the management of ADM, TD and ESD for consideration and further discussions on the WWTSS improvement and modification.</li> <li>➤ In late November 2020, a DAS and scope of work were proceeded for PCD to procure a qualified contractor to improve the WWTSS in OSOV1 and main dam as well as modify the WWTSS in OSOV2.</li> </ul>
OSOV2	EF13	Non-compliance for TSS, Ammonia-Nitrogen, faecal coliform and total coliform in the first fortnightly sampling. Total nitrogen was non-complied for both fortnightly samplings.	
Main Powerhouse	EF19	Non-compliance for TSS (first fortnightly sampling), Ammonia Nitrogen, Total Nitrogen and Total Phosphorus.	

### 3.3.2 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**.

The monitoring results for key parameters (DO, TSS and BOD<sub>5</sub>) during November 2020 are presented in **Table 3-7, Table 3-8 and Table 3-9**. The full set of data for November 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 30 November 2020, the water level in the main reservoir decreased from El. 315.10 m asl to El. 314.09 m asl.

Thermal stratification, oxycline and anoxic condition were observed in the main reservoir at all stations except R1 at the upstream end of the reservoir where the reservoir behaves more like a river than a lake and therefore does not exhibit thermal stratification. In general, over the course of the month, the thermocline deepened causing the oxycline to deepen correspondingly.

At R05, during November 2020, the DO level in the upper 16 m was generally between 5 and 8 mg/L, and an oxycline had formed at a depth between 12 and 16 m corresponding to El. 298 m asl to 302 m asl with DO levels less than 2 mg/L immediately below the oxycline gradually decreasing to less than 0.5 mg/L (anoxic condition) at depths of 30 m to 40 m.

At R04, the DO level in the upper 9.5 m was generally between 5 and 7 mg/L dropping to less than 2 mg/L at depths of about 13 m to 17 m and with anoxic conditions in the entire water column below 45 m.

The DO level at R03 was recorded between 5 mg/L and 8 mg/L in the upper 6.5 m and falling to less than 2 mg/L at depths of about 10 m to 14 m, however with a peak showing DO levels of 3 mg/L to 4 mg/L appearing at about 25 m depth. This is thought to be due to inflow from the right bank tributary, Nam Phouan where the DO rich water at this time of year is about 5 °C colder than in the upper layers of the reservoir and therefore would create a deep flow path with higher DO levels than in the immediate overlying water.

At R02, the DO concentrations in the upper 2.5 m were between 5 mg/L and 8 mg/L and dropped to less than 2 mg/L at depths between 6.5 m and 12 m.

At R01, similar to previous month, the DO levels were generally between 6.1 and 8.6 mg/L in the entire water column.

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 with the 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> measurements at R03, R04 and R05 in the epilimnion were 1.7, 2.8, 1.8 and 2.1 mg/L respectively, but in the hypolimnion, BOD<sub>5</sub> was recorded at 3.6, 13.9 and 13.7 mg/L respectively.

### **Re-regulation Reservoir**

In November 2020, the turbine discharges from the main powerhouse varied between 11 and 231 m<sup>3</sup>/s 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 3 mg/L in the entire water column.

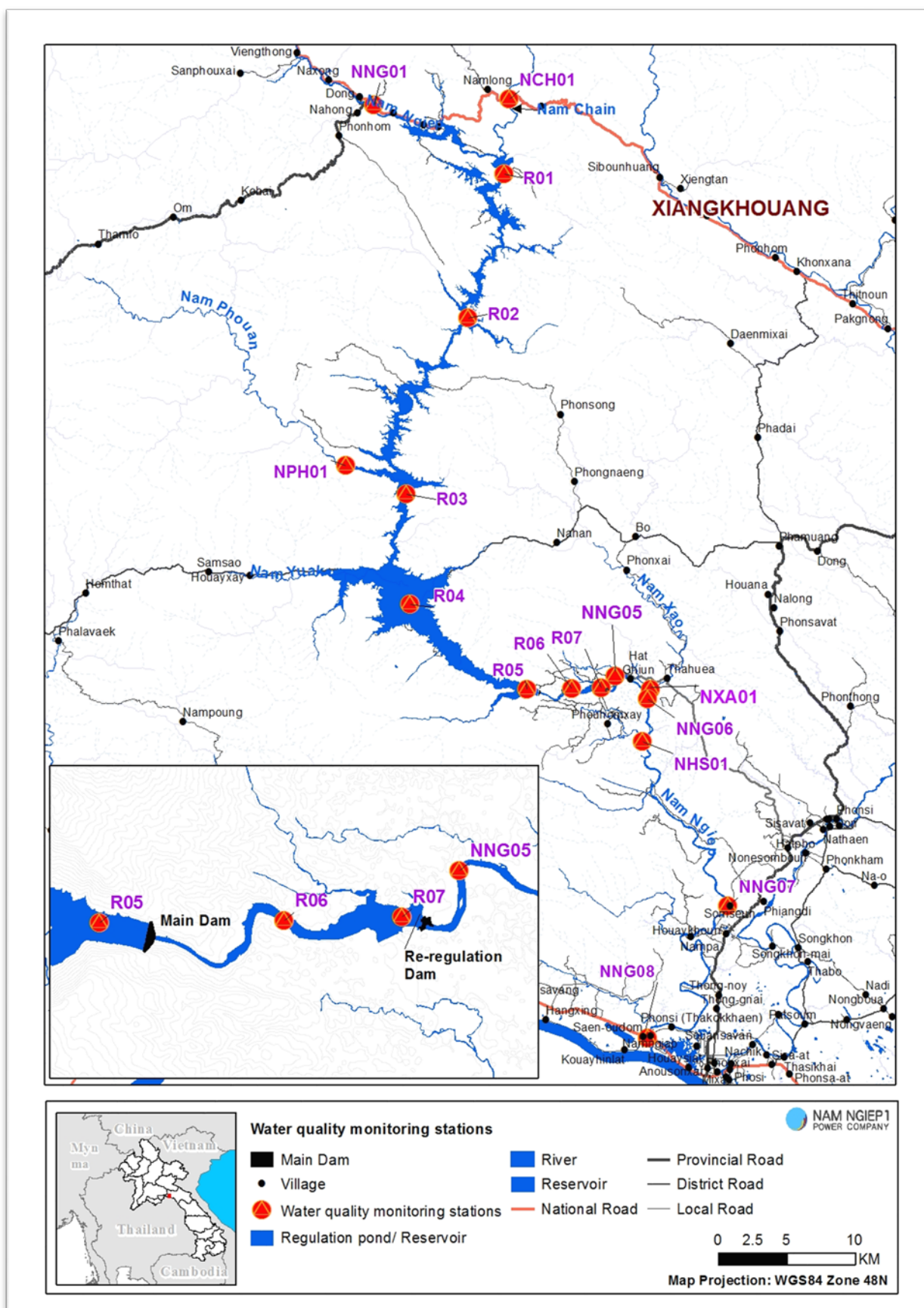
The BOD<sub>5</sub> concentrations in R06 and R07 were about 2 mg/L.

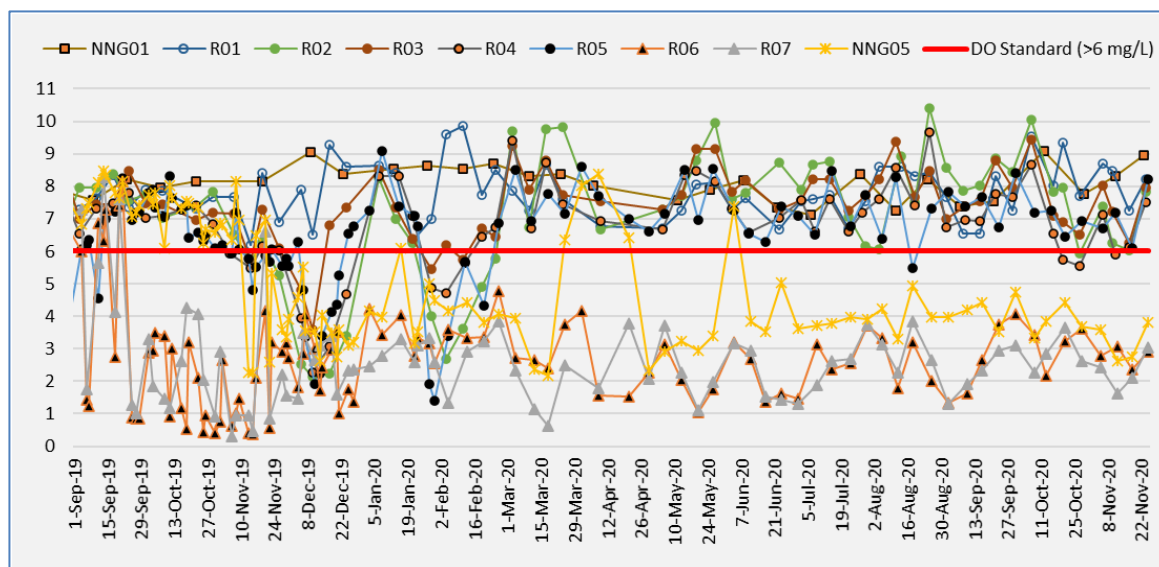
### **Downstream**

During November 2020, the discharge from the re-regulation dam mainly went through the turbine. The DO levels were less than 6 mg/L at the stations in Nam Ngiep immediately downstream of the Re-regulation Dam and thus were non-compliant with the GOL Standard. No dead fish was observed in Nam Ngiep downstream during this monitoring period. NNP1PC is in the process of collecting information to assist in developing measures to improve the DO levels downstream.

The BOD<sub>5</sub> in the downstream stations (NNG05) were below 2.1 mg/L and thus were non-compliant with the national surface water quality standard.

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



**FIGURE 3-2: CONCENTRATION OF DISSOLVED OXYGEN (MG/L) IN THE UPPER 0.2 M SINCE SEPTEMBER 2019 TO NOVEMBER 2020****TABLE 3-7: RESULTS OF SURFACE WATER QUALITY MONITORING FOR DISSOLVED OXYGEN (MG/L) IN THE UPPER 0.2 M, NATIONAL WATER QUALITY STANDARD: >6.0 MG/L**

DO (mg/L)	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
5-Nov-20							2.78	2.42	3.58	3.84	5.71	5.7			6.48	6.54
6-Nov-20		8.7	7.37	8.01	7.12	6.71										
10-Nov-20		8.49	6.26	7.23										9.3		
11-Nov-20	8.3				5.9	7.19							7.96			
12-Nov-20							3.07	1.62	2.61	2.94	4.96	5.6			7.23	6.8
17-Nov-20		7.26	6.02	6.26	6.14											
18-Nov-20						6.1	2.37	2.1	2.75	3.17	4.51	5.69			6.54	6.59
23-Nov-20	8.97												8.29			
24-Nov-20		8.22	7.83	7.97	7.52											
25-Nov-20						8.22	2.91	3.04	3.82	4.85	6.34	6.89			7.46	7.76

**TABLE 3-8: RESULTS OF SURFACE WATER QUALITY MONITORING FOR TOTAL SUSPENDED SOLIDS (MG/L)**

Total Suspended Solids (mg/L)	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
10-Nov-20	6.47	<5		<5										<5		
10-Nov-20				7.35												
11-Nov-20					<5	<5							<5			

Total Suspended Solids (mg/L)	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
11-Nov-20					<5	<5										
12-Nov-20							<5	<5	<5	<5	5.2	14.2			<5	<5

**TABLE 3-9: RESULTS OF SURFACE WATER QUALITY MONITORING FOR BOD5 (MG/L) - WATER QUALITY STANDARD: < 1.5 MG/L**

BOD <sub>5</sub> (mg/L)	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
10-Nov-20		1.71		2.8										1.16		
10-Nov-20 Hypolimnion				3.6												
11-Nov-20	<1				1.8	2.1							<1			
11-Nov-20 Hypolimnion					13.9	13.72										
12-Nov-20							2.06	2.08	2.14	1.4	<1	<1			<1	<1

### 3.3.3 Groundwater Quality Monitoring

During November 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 that two newly installed wells in Phouhomxay Village and one well in Pou Village comply fully with the groundwater quality standards.

Faecal Coliform and *E.coli* Bacteria are still present in the wells of Somseun, Nam Pa and Thong Noy Villages. The villagers were advised to boil water before drinking. This advice is in accordance with the Law on Hygiene, Disease Prevention and Health Promotion No 01/NA of 10 April 2001, which states that domestic water supply for daily use is not required to be readily drinkable but would normally have to be boiled or otherwise treated before it would be suitable for drinking. The villagers generally use tap water for washing and cleaning. They were informed about the monitoring results and recommended to carry out the operation and maintenance improvement as well as were encouraged to boil water before drinking. The groundwater quality monitoring results are presented in **Table 3-10**.

**TABLE 3-10: GROUNDWATER QUALITY MONITORING RESULTS IN SOMSUEN, NAM PA, THONGNOY AND POU VILLAGES**

	Site Name	Phouhomxay Village		Somseun Village	NamPa Village	ThongNoy Village	Pou Village
Parameter (Unit)	Station	GPHX01	GPHX02	GSXN01	GNPA01	GTHN01	GPOU01
	Guideline						
pH	6.5 - 9.2	6.83	6.92	7.09	6.98	6.55	7.73
Sat. DO (%)		33	34.9	77.9	84.2	59.3	95.7

	Site Name	Phouhomxay Village		Somseun Village	NamPa Village	ThongNoy Village	Pou Village
Parameter (Unit)	Station	GPHX01	GPHX02	GSXN01	GNPA01	GTHN01	GPOU01
	Guideline						
DO (mg/L)		2.68	2.87	6.3	6.81	4.75	7.97
Conductivity (µS/cm)		400	396	295	430	397	28
Temperature (°C)		25.81	25.33	26.06	26.23	26.71	24.45
Turbidity (NTU)	<20	2.93	3.12	2.09	1.65	1.78	2.68
Fecal Coliform (MPN/100mL)	0	0	0	4.5	2	140	0
E.coli (MPN/100mL)	0	0	0	2	0	79	0

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

Surface water from Houay Soup Stream is no longer used as water supply source for Phouhomxay Village since the two new groundwater boreholes (*GPHX01* and *GPHX02*—**Table 3-10**) were connected to the existing water supply tanks on 21 October 2020.

The results of the water quality analyses are presented in **Table 3-11**. All parameters complied with the GoL Drinking Water Standards for Phouhomxay Village's water supply after the ground water sources were connected.

Faecal Coliform and *E.coli* exceeded the standards in the water supply of Thaheua and Hat Gnuin Villages (WTHH02 and WHGN02). As observed in the field during water sampling, livestock are roaming around the water intake areas which may contribute to the presence of Faecal Coliform Bacteria and *E.coli* in GFWS samples. The villagers were advised to boil water before drinking. This advice is in accordance with the Law on Hygiene, Disease Prevention and Health Promotion No 01/NA of 10 April 2001, which states that domestic water supply for daily use is not required to be readily drinkable but would normally have to be boiled or otherwise treated before it would be suitable for drinking. 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 3-11: RESULTS OF THE GRAVITY FED WATER SUPPLY QUALITY MONITORING**

	Site Name	Thaheua Village	Hat Gnuin Village	Phouhomxay Village	
	Station	WTHH02	WHGN02	WPHX02	WPHX03
Parameter (Unit)	Guideline				
pH	6.5 - 8.6	7.91	7.77	7.27	7.16
Sat. DO (%)		105.1	96.4	71.8	70.9
DO (mg/L)		8.14	7.89	5.79	5.84
Conductivity (µS/cm)	<1,000	59	76	392	387
Temperature (°C)	<35	28.64	25.37	26.2	25.18
Turbidity (NTU)	<10	3.38	2.09	2.41	2.89
Faecal Coliform (MPN/100 mL)	0	79	27	0	0
E.coli Bacteria (MPN/100 mL)	0	27	17	0	0

### 3.3.5 Landfill Leachate Monitoring

During November 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 both NNP1 Project Landfill and Houay Soup Landfill fully complied with the standards. The landfill leachate monitoring results for November 2020 can be found in **Table 3-12**.

**TABLE 3-12: 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
			Station	LL1	LL2	LL3	LL4	LL5	LL6
Date	Parameter (Unit)	Guideline							
3-Nov-20	pH	6.0-9.0					8.38		8.96
3-Nov-20	Sat. DO (%)						110.3		227.4
3-Nov-20	DO (mg/L)						8.26		16.86
3-Nov-20	Conductivity (µS/cm)						46		123.9
3-Nov-20	Temperature (°C)						29		29.6
3-Nov-20	Turbidity (NTU)						10.59		19.17
3-Nov-20	BOD <sub>5</sub> (mg/L)	<30					8.7		11.7
3-Nov-20	COD (mg/L)	<125					41.4		60.6
3-Nov-20	Faecal Coliform (MPN/100mL)	<400					0		0
3-Nov-20	Total Coliform (MPN/100mL)	<400					920		5
3-Nov-20	Total nitrogen (mg/L)	<10					0.61		0.88
3-Nov-20	Lead (mg/L)	<0.2					<0.01		<0.01
3-Nov-20	Copper (mg/L)						<0.006		<0.006
3-Nov-20	Iron (mg/L)						0.545		0.418
3-Nov-20	Ammonia nitrogen (mg/L)	<10					<2		<2

### 3.3.6 Discharge Monitoring

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

The water level in the main reservoir, inflow to the reservoir and discharge from the reservoir have been monitored since the start of the impounding on 15 May 2018. The graph in **Figure 3-4** presents the values recorded since 01 January 2019.

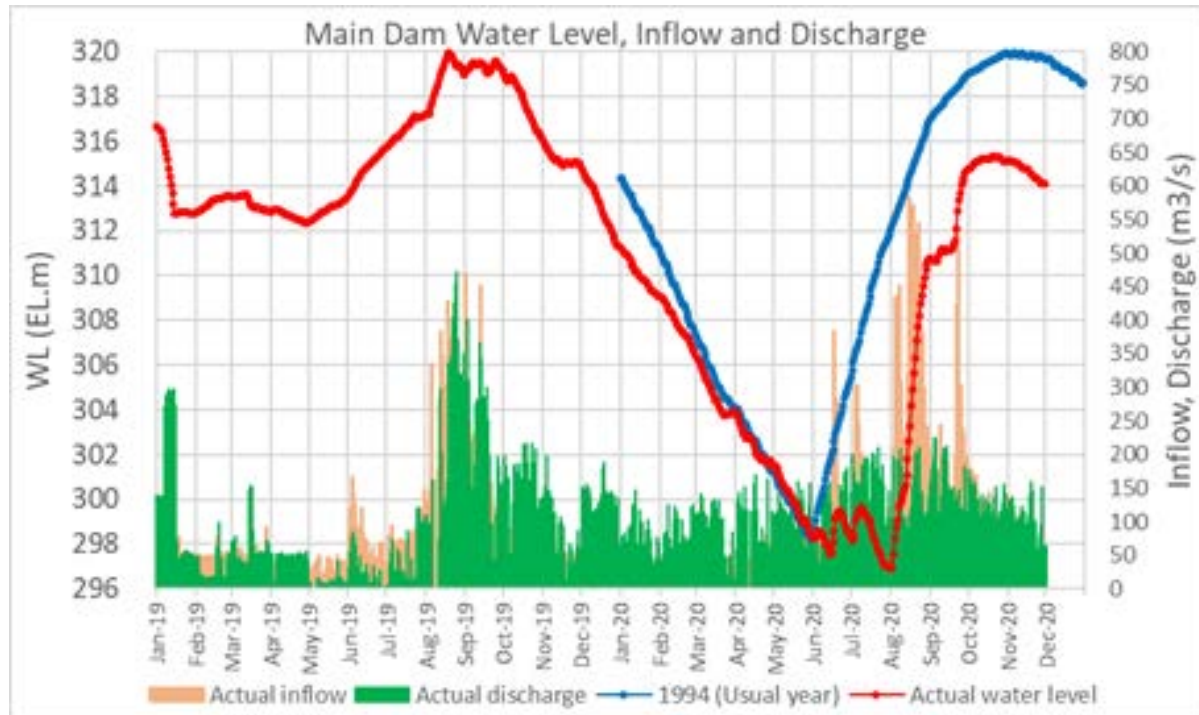
During November 2020, the mean inflow to the main reservoir was 96 m<sup>3</sup>/s during the first two weeks where after the inflow decreased to a mean of about 73 m<sup>3</sup>/s during the remaining part

of November 2020 corresponding to the end of wet season. The minimum and maximum inflow were 43 (on 29 November 2020) and 118 m<sup>3</sup>/s (on 01 November 2020) respectively.

From 01 to 30 November 2020, water level of the main reservoir was slightly decreased by 1.01 m from El. 315.10 m asl to El. 314.09 m asl on 30 November 2020.

In November 2020, the turbine discharges from the Main Powerhouse varied between 11 and 231 m<sup>3</sup>/s usually interrupted by night-time periods with no discharge.

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

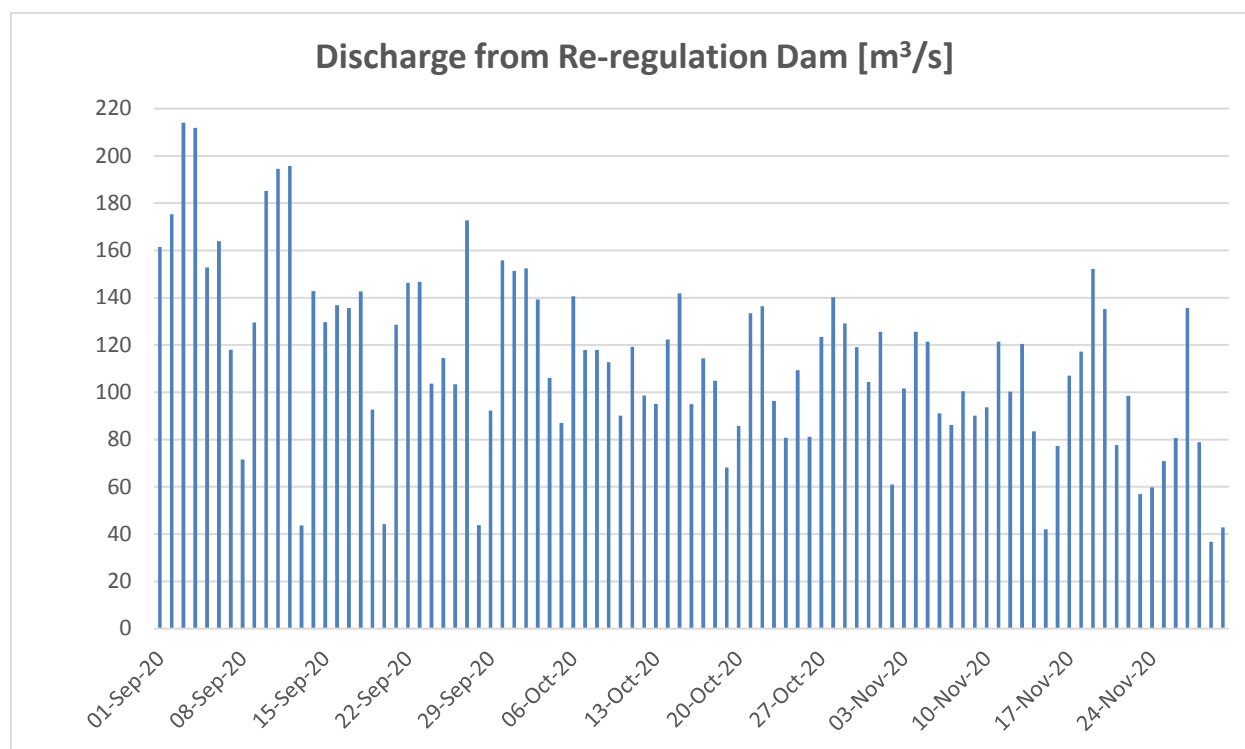


### 3.3.6.2 Re-regulation Reservoir – Discharge

The discharge monitoring data for the re-regulation dam during September to November 2020 is presented in **Figure 3-5**.

During November 2020, the mean discharge from the Re-regulation Dam was about 135 m<sup>3</sup>/s with turbine discharges varying between 48 m<sup>3</sup>/s and 162 m<sup>3</sup>/s, combined with gate discharge varying between 27 m<sup>3</sup>/s and 221 m<sup>3</sup>/s. The discharge was kept above the minimum flow requirement of 27 m<sup>3</sup>/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 SEPTEMBER TO NOVEMBER 2020**

### 3.3.7 Nam Ngiep Downstream Water Depth Monitoring

In November 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 but none of them were found to be difficult to navigate.

## 3.4 PROJECT WASTE MANAGEMENT

### 3.4.1 Solid Waste Management

In November 2020, a total of 17.8 m<sup>3</sup> of solid waste was disposed of at the NNP1 Project Landfill, a decrease of 2.2 m<sup>3</sup> compared with October 2020.

During November 2020, the local Waste Collection Contractor continued the routine operation and maintenance activities of both landfills which included waste separation, waste covering and waste inventory, and clean-up of vegetation and scattered waste. In addition, the Contractor has also continue assisted on segregation of recyclable waste and clean up in the community waste bank.

No recyclable waste was sold this month. The cumulative amounts are presented in **Table 3-13**.

**TABLE 3-13: AMOUNTS OF RECYCLABLE WASTE SOLD**

Source and Type of Recycled Waste		Unit	Sold	Cumulative Total by November 2020
1	Plastic bottle	kg	0	96
2	Aluminium	kg	0	108
3	Paper/ Cardboard	kg	0	63
4	Glass	kg	0	64
<b>Total</b>		<b>kg</b>	<b>0</b>	<b>331</b>

The villagers from Phouhomxay Village collected a total of 505.5 kg of food waste from the OSOV1 canteen for animal feed in November 2020, a decrease of 193 kg compared with the previous month.

### 3.4.2 Hazardous Materials and Waste Management

The types and amounts of hazardous material and hazardous waste stored on site in November 2020 are shown in **Table 3-14** and **Table 3-15**.

**TABLE 3-14: RECORD OF HAZARDOUS MATERIAL INVENTORY**

No.	Type of Hazardous Material	Unit	Total in October 2020 (A)	Used (B)	Remaining (A – B)
1	Diesel	Litre	6,530	5,629	<b>901</b>
2	Gasoline	Litre	918	280	<b>638</b>
3	Lubricant (Turbine oil)	Litre	7,210	0	<b>7,210</b>
4	Colour Paint	Litre	266	0	<b>266</b>
5	Thinner	Litre	12	0	<b>12</b>
6	Grease Oil	Litre	725	0	<b>725</b>
7	Gear Oil	Litre	220	0	<b>220</b>
8	Chlorine Liquid	Litre	160	40	<b>120</b>
9	Chlorine Powder	Kg	65	0	<b>65</b>
10	SIKA	Litre	7	0	<b>7</b>

**TABLE 3-15: RECORD OF HAZARDOUS WASTE INVENTORY**

No.	Hazardous Waste Type	Unit	Total in October 2020 (A)	Disposed (B)	Remaining (A - B)
1	Used Oil (Hydraulic and Engine)	Litre	197	0	<b>197</b>
2	Empty 200L drum of used oil	Unit	3	0	<b>3</b>
3	Contaminated soil, sawdust and textile material	m <sup>3</sup>	0.42	0	<b>0.42</b>
4	Used tires	Piece	13	0	<b>13</b>

No.	Hazardous Waste Type	Unit	Total in October 2020 (A)	Disposed (B)	Remaining (A - B)
5	Empty 20L chemical drum	Drum	5	0	5
6	Lead battery	Unit	3	0	3
7	Empty paint and spray cans	Can	133	0	133
8	Halogen/fluorescent bulbs	Unit	223	0	223
9	Empty cartridge (Ink)	Unit	159	0	159
10	Clinic Waste	Kg	6.2	0	6.2

### 3.5 COMMUNITY WASTE MANAGEMENT

#### 3.5.1 Community Recycling Programme

In November 2020, there was no trading of recyclable waste at the community waste bank. Due to the COVID-19 measures, many local recycling businesses and vendors have stopped coming on site to trade recyclable waste, and 283 kg out of a total 579.5 kg cardboard and 28.5 kg out of 63.5 kg of plastic bottles stored in the community waste bank had become unsellable and were disposed of at Houay Soup Landfill. A total of 54 kg of glass bottles from the landfills was added to the waste bank making a new total amount of 2,689.5 kg recyclable waste in the bank.

**TABLE 3-16: TYPES AND AMOUNTS OF RECYCLABLE WASTE TRADED AT THE COMMUNITY RECYCLE WASTE BANK**

Types of Waste	Unit	Remaining in October 2020	Additional in November 2020	Sold/ dispose	Remaining in November 2020
Glass bottles	kg	2,304	54	0	2,358
Paper/ cardboard	kg	579.5	0	283	296.5
Plastic bottles	kg	63.5	0	28.5	35
Aluminium cans	kg	0	0	0	0
Scrap metal	kg	0	0	0	0
<b>Total</b>	<b>kg</b>	<b>2,947</b>	<b>54</b>	<b>311.5</b>	<b>2,689.5</b>

#### 3.5.2 Community Solid Waste Management

In November 2020, approximately 15.7 m<sup>3</sup> of solid waste was collected from Phouhomxay Village and the host villages for disposal at Houay Soup landfill, an increase of 3.1 m<sup>3</sup> compared with the previous month.

**FIGURE 3-5: WASTE MANAGEMENT ACTIVITIES DURING NOVEMBER 2020**

<b>SOLID WASTE COLLECTION IN PHOUHOMXAY VILLAGE'S SCHOOL (RESETTLEMENT VILLAGE)</b>	<b>WASTE DISPOSAL AT NNP1 LANDFILL</b>
	
<b>DAILY WASTE COVERING AT HS LANDFILL</b>	<b>THE LOCAL WASTE COLLECTION CONTRACTOR SOLD THEIR RECYCLE WASTE SEGREGATED FROM LANDFILLS (INCENTIVE)</b>
	

### 3.6 WATERSHED AND BIODIVERSITY MANAGEMENT

#### 3.6.1 Watershed Management

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

As of end of November 2020, the final draft of Fishery Co-Management Plan (FCMP) in Lao language that was submitted to Xaysomboun PAFO on 27 October 2020 is still being reviewed.

The final report in Lao language of the Assessment on Sustainable Livelihood Opportunities for NNP1 watershed communities is being further improved. The report will be shared to Xaysomboun Provincial WRPO for their reference to implement the activities under component 5 of NNP1 WMP – Livelihood Improvement in December 2020.

Three days Water Safety Training was organized by NNP1PC-EMO in collaboration with Lao Red Cross on 03-05 November 2020 at Bolikhamxay PAFO and NNP1PPC OSOV. The training was attended by 11 representatives from NNP1PC, two representatives from Hom DAFO, two representatives from Thathom DAFO, two representatives from Bolikhan DAFO and one representative from BLX WRPO. During the training the participants learned first aid, safe working in water, victim management and rescue, swimming technique, and boat operation.

**FIGURE 3-6 : PHOTOS DURING THE WATER SAFETY TRAINING 03-05 NOVEMBER 2020 (FIRST AID, VICTIM MANAGEMENT AND RESCUE, SWIMMING TECHNIQUE)**



**FIGURE 3-7 : PHOTOS DURING THE WATER SAFETY TRAINING 03-05 NOVEMBER 2020 (BOAT OPERATION AND SAFETY WORKING IN THE WATER)**



Bolikhamxay Provincial WRPO commenced reservoir and forest patrolling between 12-19 November 2020. The reservoir patrolling team had to return back on 15 November 2020 because of an issue with the boat engine. Bolikhamxay WRPO is preparing a report of their patrolling until the end of November 2020. The report will be shared to NNP1PC-EMO and BSP team afterward.

NNP1PC officially requested DOF-MAF to have the funds for implementing their activities transferred in local currency (LAK). DOF-MAF is processing the change of the bank account which is expected to be completed in early December 2020, and the fund disbursement is then expected to be settled within the second week of December 2020. The schedule for Xaysomboun activities under the approved AIP2020 will be adjusted accordingly.

NNP1PC management planned to discuss the issues related to GOL financial policy affecting the field activities under watershed and biodiversity program during the joint PRLRC meeting which is scheduled to be held in December 2020.

#### **3.6.1.2 Preparation of Annual Implementation Plan (AIP) 2021**

Bolikhamxay Provincial WRPO and NNP1PC-EMO discussed on the proposed activities that are related with the draft budget of their AIP2021 on 19 November 2020. NNP1PC-EMO had further discussions with the BSP on their patrolling plan and provided additional comments and recommendations for improvement at the end of November 2020.

Xaysomboun Provincial WRPO is still working on their draft AIP2021 until the end of November 2020. NNP1PC EMO expect to receive their draft plan within December 2020.

The discussions on the draft AIP2021 between DOF-MAF, WRPOs, NNP1PC-EMO, and BSP is expected to be delayed to December 2020.

### 3.6.2 Biodiversity Offset Management

#### 3.6.2.1 Engagement of Biodiversity Service Provider (BSP)

The signing of the MOU between NNP1PC, ADB and WCS is pending, some clauses are still being discussed.

NNP1PC-EMO and the BSP continued to make progress on 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, and the conservation linked livelihood.

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

The progress on the implementation of key activities by Component in November 2020 are described below:

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

The dissemination and outreach activity on the TPZ boundary will be re-scheduled after another training program with the topics on crime scene and evidence, firearm safety, hostile situation, and SMART for NC-NX BOMU and its ranger team. The training program was scheduled in the first week of December 2020.

##### b. Component 2 – Law Enforcement

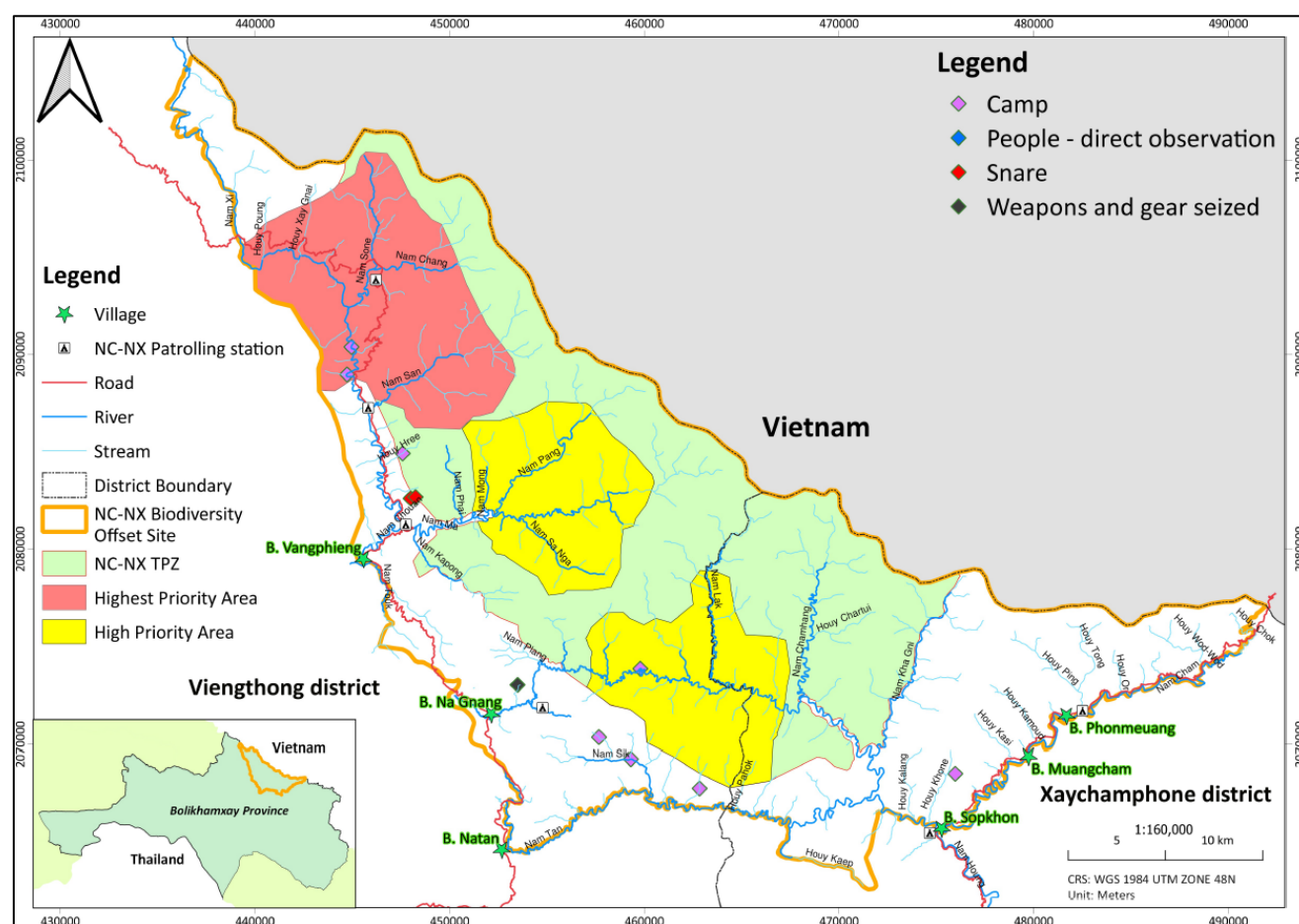
The four patrol teams continued the patrolling between 07 and 27 November 2020 with the focus on TPZ Highest priority area including Nam Sone, Houy Pong Nam Chang, Houy Xay Gnai, and Houy Xay Noi; Nam Ma TPZ High priority area including Nam Ma and ridge of mountain; and Nam Houng TPZ High priority area in Viengthong District including Nam Houng, Nam Lak, Nam Somfard and Nam Kapa. The results of November 2020 patrolling will be presented and discussed in December 2020 Monthly Report.

The results of patrolling activity in October 2020 are as follow:

Team	Patrolling Area/distance	Observations/Actions Taken
1	Nam Houng TPZ high priority area including Nam Houng, Nam Kha Gna, Nam Sik, Houy Kanang, Houy Vangmoun (16 days covering a distance of 82 km on forest patrolling)	The team encountered and destroyed two hunting camps at Nam Sik, one new hunting camp at Nam Kanang and one old hunting camp at Nam Houng. The team suspected that the camps were used by local hunters from Na Gngang Village. The team also observed one local hunter from Na Gngang Village with a home-made gun near Nam Houng but the hunter escaped from the pursuit and so the gun could not be confiscated.
2	TPZ highest priority including Houy Hree, Houy Phai, Nam San, Nam Chouan and Nam Sone	The team encountered and destroyed one new and one old small fishing camp at Nam Chouan, and one small old hunting camp at Houy Hree. The team also found carcasses of three wildlife species including some bone of wild pig, hair of muntjac and <i>East Asian Porcupine</i> around the patrol sub-station in

Team	Patrolling Area/distance	Observations/Actions Taken
	(16 days covering a distance of 48 km on forest patrolling and 45 km on road patrolling)	Thongnachang. The team suspected that the local hunter might avoid the route passing through the sub-station or disguised themselves to farm in the nearby rice fields which are outside the TPZ area.
3	Nam Ma TPZ high priority area including Nam Ma and Nam Pang (8 days covering a distance of 23 km)	The team encountered and destroyed the total of 15 large wire snares close to Nam Ma sub-station which were identified to be set by local hunters from Vangphieng Village. They could only spend 8 days because of the heavy rain and the issue of their GPS.
4	Xaychamphon District including Houy Chok, Houy Or, Houy Ping, Houy Tong, Houy Bon, Houy Kamoud, Houy Khone and Houy Kalang (16 days covering a distance of 56 km on forest patrolling and 33 km on road patrolling)	The team encountered and destroyed a small hunting camp at Houy Khone which was suspected to be used by local hunter from Sopkhone Village.

**FIGURE 3-8: MAP OF THREATS RECORDED BY PATROLLING TEAMS IN OCTOBER 2020**



**FIGURE 3-9: HUNTING CAMP FOUND AND DESTROYED BY TEAM 1**



**FIGURE 3-10: FISHING CAMP FOUND AND DESTROYED BY TEAM 2**



**FIGURE 3-11: LINES OF SNARES FOUND BY TEAM 3**



**FIGURE 3-12: LARGE WIRE SNARES COLLECTED AND DESTROYED BY TEAM 3**



**FIGURE 3-13: HUNTING CAMP FOUND AND DESTROYED BY TEAM 4**



**c. Component 3 – Conservation Outreach**

The pre-assessment of the target communities and schools was implemented between 11-21 November 2020. The results will be discussed during the BOMU monthly meeting in December 2020.

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

The workshop for presenting the draft CDP to BOMU and relevant GOL agencies was organized on 10 November 2020 and attended by 42 participants. The draft MoM was prepared by NNP1PC-EMO and submitted to BOMU for finalization and signing.

The Consultant, NNP1PC-EMO, and BSP further improved the draft plan (English version) addressing the comments from ADB, IAP, and from the workshop with relevant GOL agencies. The revised version was submitted to ADB on 27 November 2020.

The Community Snare Removal Plan was further improved and discussed during monthly meeting on 05 November 2020. The plan was finalized and submitted to BOMU on 20 November 2020. The team establishment, the training and the first snare removal are scheduled in December 2020.

**e. Component 6 – Biological Monitoring**

BSP and NNP1PC-EMO presented the improved biological monitoring matrix to NC-NX BOMU and Xaysomboun WRPO on 20 and 25 November 2020 respectively.

NC-NX BOMU, NNP1PC-EMO, and BSP team installed a total of 100 camera traps at 56 target locations within NC-NX offset site during 27 October to 27 November 2020. All the cameras are expected to be retrieved in January 2021 after 50 days of recording.

**3.6.2.3 BOMP Annual Implementation Plan (AIP) 2021**

Bolikhamxay Provincial NC-NX BOMU had another discussion with NNP1PC-EMO and BSP on the draft AIP2021 on 05-06 November 2020. NC-NX BOMU was further improving the draft with the inputs from NNP1PC-EMO and BSP until the end of November 2020. The revised draft is expected to be ready for submission to ADB in December 2020.

**3.7 FLOATING DEBRIS REMOVAL**

NNP1PC-EMO team removed some logs from temporary log-booms in the second week of November 2020.

## 4. FISHERY MONITORING

Three species groups and two species dominated the fish catch by weight in October 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 species (VU).

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

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
<i>Poropuntius normani</i> , <i>Poropuntius laoensis</i> , <i>Poropuntius carinatus</i>	ປາຈາດ	133.5	LC
<i>Hampala dispar</i> , <i>Hampala macrolepidota</i>	ປາສຸດ	127.7	LC
<i>Channa striata</i>	ປາຄໍ້	97.9	LC
<i>Tor sinensis</i>	ປາແດງ	71.3	VU
<i>Barbonymus gonionotus</i> , <i>Hypsibarbus malcomi</i> , <i>Hypsibarbus vernayi</i> , <i>Hypsibarbus wetmorei</i>	ປາປາກ	93.6	LC

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

**TABLE 4-2: THREATENED SPECIES OF OCTOBER 2020 FISH CATCH**

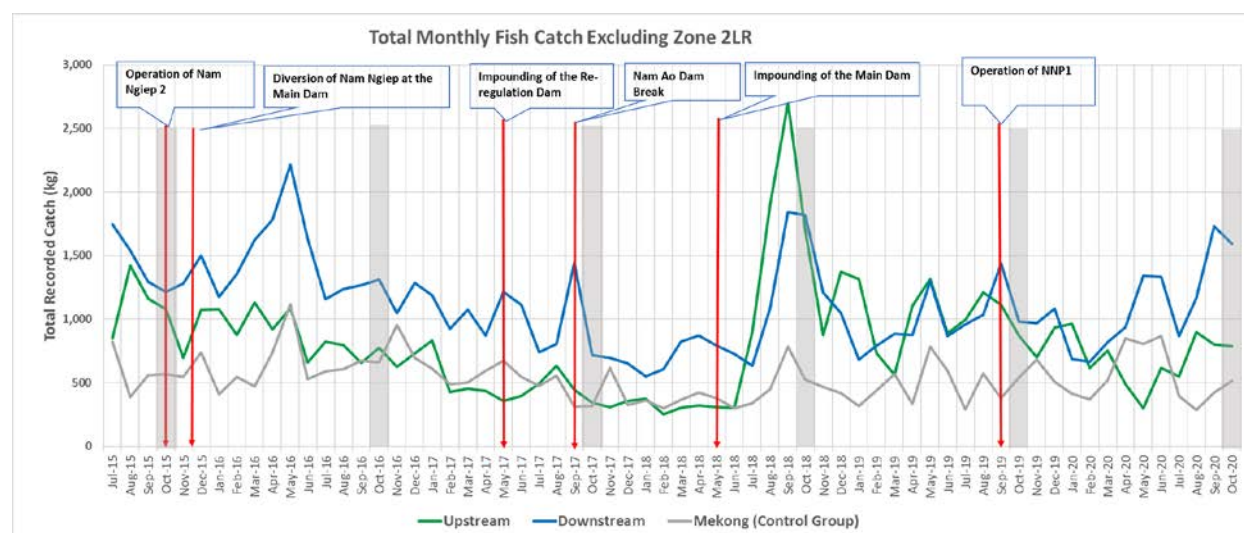
Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
<i>Cirrhinus molitorella</i>	ປາແກງ	27.6	NT
<i>Cyprinus carpio</i>	ປາໄນ	0.7	VU
<i>Neolissochilus stracheyi</i>	ປາສອງ	21.2	NT
<i>Onychostoma gerlachi</i>	ປາຄຶງ	4.2	NT
<i>Scaphognathops bandanensis</i>	ປາວຽນໄຟ/ປາປຽນ	20.5	VU
<i>Tor sinensis</i>	ປາແດງ	71.3	VU

The total recorded monthly fish catch for the downstream and upstream fishing households and the Mekong control group involved in the monitoring programme from July 2015 to October 2020

<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.

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 of 2017.

**FIGURE 4-1: TOTAL MONTHLY FISH CATCH JULY 2015 – OCTOBER 2020**

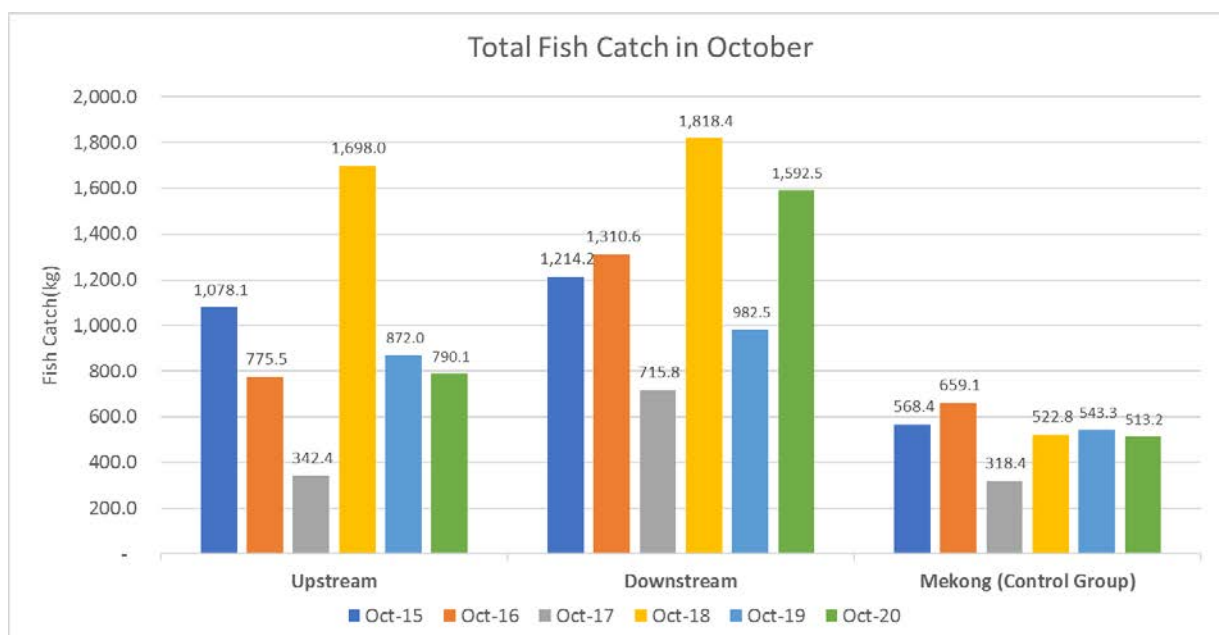


**Table 4-3** and **Figure 4-2** show the total recorded fish catch for the month of October from 2015 to 2020 in the upstream (excluding Zone 2LR) and downstream communities and the Mekong control group. The total fish catch data represents the total fish supply provided by the involved fishing households.

**TABLE 4-3: TOTAL FISH CATCH BY UPSTREAM (EXCLUDING ZONE 2LR), DOWNSTREAM AND MEKONG CONTROL GROUP FISHING HOUSEHOLDS FOR THE MONTH OF OCTOBER FROM 2015 TO 2020**

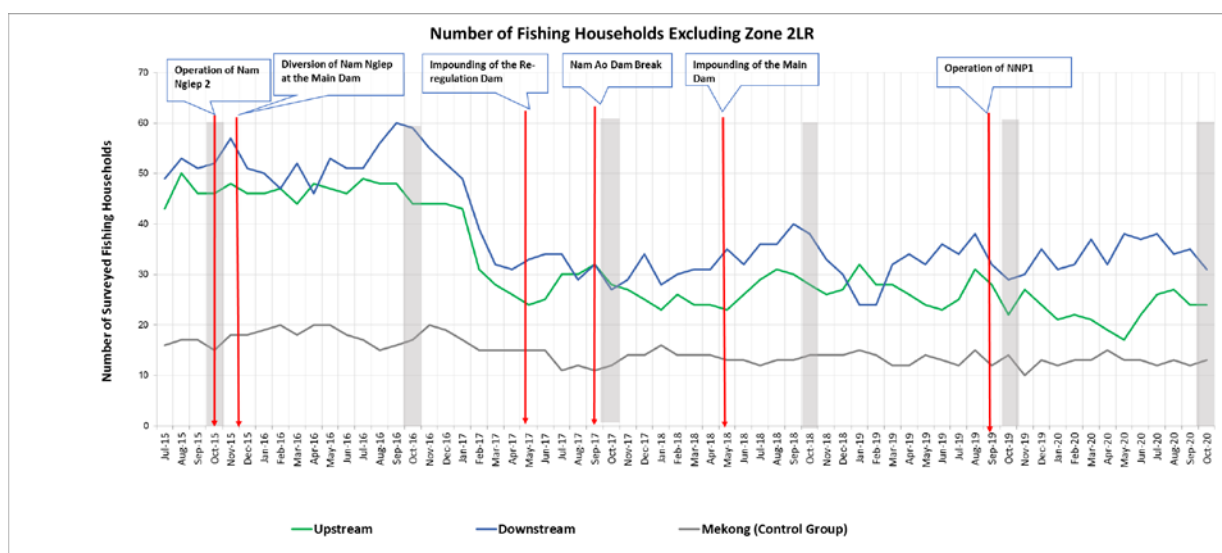
Fishing Zone	October 2015 (kg)	October 2016 (kg)	October 2017 (kg)	October 2018 (kg)	October 2019 (kg)	October 2020 (kg)
Upstream	1,078.1	775.5	342.4	1,698.0	872.0	790.1
Downstream	1,214.2	1,310.6	715.8	1,818.4	982.5	1,592.5
Mekong Control Group	568.4	659.1	318.4	522.8	543.3	513.2

**FIGURE 4-2: TOTAL FISH CATCH BY UPSTREAM (EXCLUDING ZONE 2LR), DOWNSTREAM AND MEKONG CONTROL GROUP FISHING HOUSEHOLDS FOR THE MONTH OF OCTOBER FROM 2015 TO 2020**

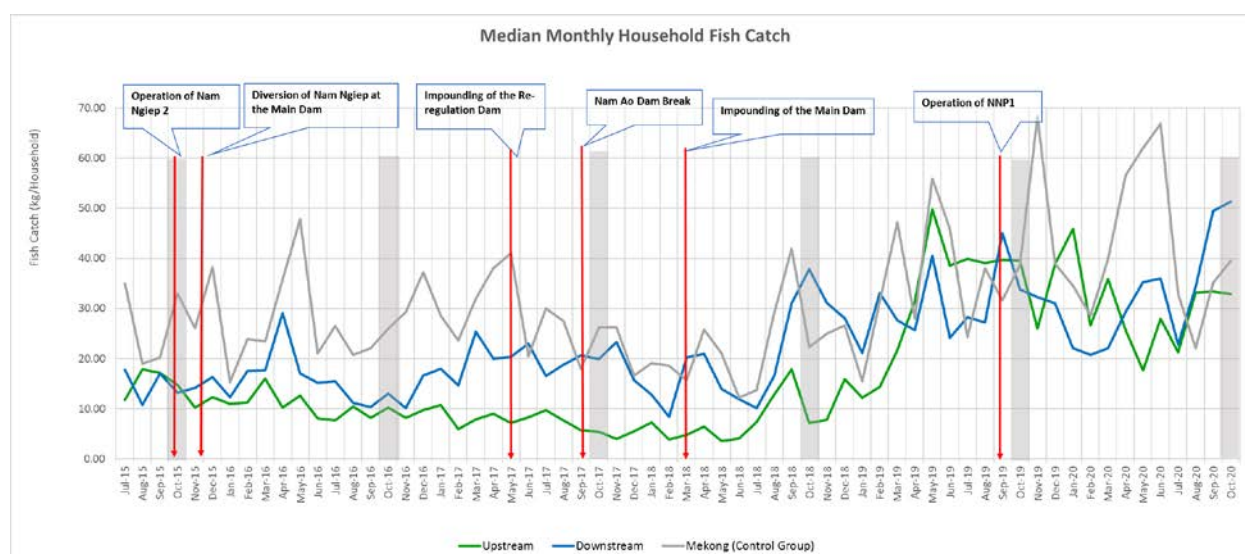


The numbers of fishing households involved in the fish catch monitoring programme are displayed in **Figure 4-3**.

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



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

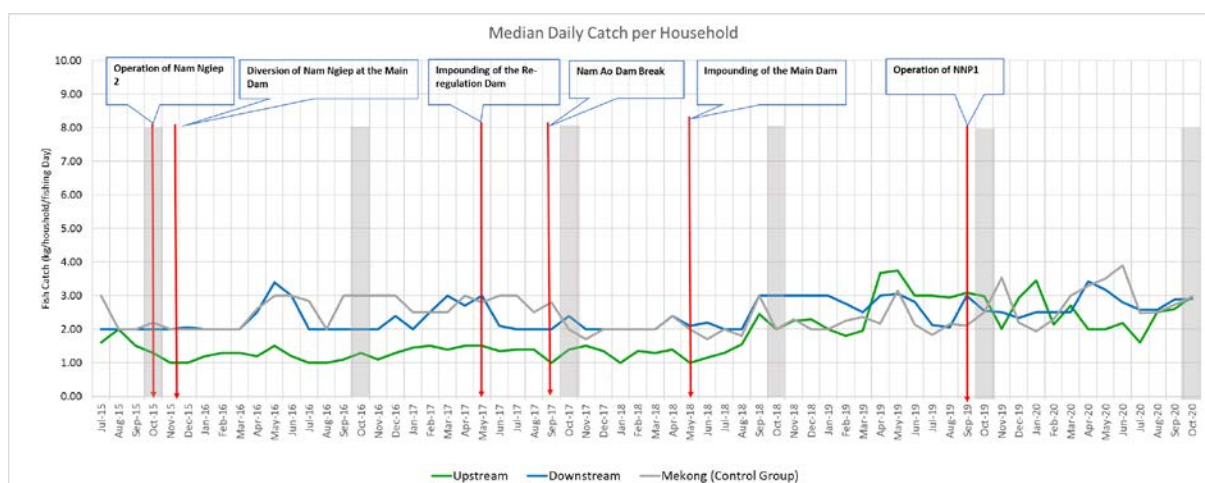
**FIGURE 4-4: MEDIAN MONTHLY HOUSEHOLD FISH CATCH WITHOUT ZONE 2LR**

The median household fish catch for the month of October from 2015 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 OCTOBER FROM 2015 TO 2020**

Fishing Zone	October 2015 (kg)	October 2016 (kg)	October 2017 (kg)	October 2018 (kg)	October 2019 (kg)	October 2020 (kg)
Upstream	14.8	10.3	5.5	7.2	39.6	32.9
Downstream	13.2	13.0	19.9	37.8	33.9	51.4
Mekong Control Group	33.0	26.0	26.3	22.3	38.8	39.5

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 October from 2015 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 OCTOBER FROM 2015 TO 2020**

Fishing Zone	October 2015 (kg)	October 2016 (kg)	October 2017 (kg)	October 2018 (kg)	October 2019 (kg)	October 2020 (kg)
Upstream	1.30	1.30	1.40	2.00	2.98	2.97
Downstream	2.00	2.00	2.40	3.00	2.55	2.90
Mekong Control Group	2.20	3.00	2.00	2.00	2.50	2.97

# **ANNEXES**

## ANNEX A: RESULTS OF WATER QUALITY MONITORING

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

		River Name	Nam Ngiep											
		Zone	Location Refer to Construction Sites											
			Upstream/Main Reservoir						Within / Re-regulation Reservoir		Downstream			
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08
Date	Parameters (Unit)	Guideline												
5-Nov-20	pH	5.0 - 9.0							6.63	7.68	6.67	6.61	7.13	7.22
6-Nov-20	pH	5.0 - 9.0		7.29	7.38	7.22	7.1	6.58						
10-Nov-20	pH	5.0 - 9.0		6.84	7.38	7.31								
11-Nov-20	pH	5.0 - 9.0	7.77				7.22	7.64						
12-Nov-20	pH	5.0 - 9.0							7.44	7.3	7.1	7.24	7.09	7.2
17-Nov-20	pH	5.0 - 9.0		7.25	6.42	6.91	6.99							
18-Nov-20	pH	5.0 - 9.0						6.88	6.94	7.02	6.98	6.95	7.03	7.03
23-Nov-20	pH	5.0 - 9.0	7.93											
24-Nov-20	pH	5.0 - 9.0		6.2	6.56	6.18	6.51							
25-Nov-20	pH	5.0 - 9.0						7.08	6.88	6.83	6.77	6.91	6.78	6.74
5-Nov-20	Sat. DO (%)								33.4	29.2	43.4	46.6	69.9	69.7
6-Nov-20	Sat. DO (%)			110.4	92.9	100.7	89	83.3						
10-Nov-20	Sat. DO (%)			106.2	78.2	90.5								
11-Nov-20	Sat. DO (%)		104.1				73.1	89.6						
12-Nov-20	Sat. DO (%)								36.5	19.2	30.9	35.4	60.1	68.3
17-Nov-20	Sat. DO (%)			91.8	76	78	75.8							
18-Nov-20	Sat. DO (%)							75.1	28.5	25.3	33.1	38.3	54.8	69.6
23-Nov-20	Sat. DO (%)		112											
24-Nov-20	Sat. DO (%)			106.1	100	100.1	94.6							
25-Nov-20	Sat. DO (%)							1024	34.8	36.3	46.1	59.9	78.7	85.7
5-Nov-20	DO (mg/L)	>6.0							2.78	2.42	3.58	3.84	5.71	5.7
6-Nov-20	DO (mg/L)	>6.0		8.7	7.37	8.01	7.12	6.71						
10-Nov-20	DO (mg/L)	>6.0		8.49	6.26	7.23								
11-Nov-20	DO (mg/L)	>6.0	8.3				5.9	7.19						
12-Nov-20	DO (mg/L)	>6.0							3.07	1.62	2.61	2.94	4.96	5.6

		River Name	Nam Ngiep											
		Zone	Location Refer to Construction Sites											
			Upstream/Main Reservoir						Within / Re-regulation Reservoir		Downstream			
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08
Date	Parameters (Unit)	Guideline												
17-Nov-20	DO (mg/L)	>6.0		7.26	6.02	6.26	6.14							
18-Nov-20	DO (mg/L)	>6.0					6.1	2.37	2.1	2.75	3.17	4.51	5.69	
23-Nov-20	DO (mg/L)	>6.0	8.97											
24-Nov-20	DO (mg/L)	>6.0		8.22	7.83	7.97	7.52							
25-Nov-20	DO (mg/L)	>6.0					8.22	2.91	3.04	3.82	4.85	6.34	6.89	
5-Nov-20	Conductivity (µs/cm)							67	66	66	68	67	68	
6-Nov-20	Conductivity (µs/cm)			73	72	62	61	57						
10-Nov-20	Conductivity (µs/cm)			73	73	63								
11-Nov-20	Conductivity (µs/cm)		61.2				61	58						
12-Nov-20	Conductivity (µs/cm)							70	71	71	72	70	68	
17-Nov-20	Conductivity (µs/cm)			73	74	64	61							
18-Nov-20	Conductivity (µs/cm)							58	71	71	71	72	71	70
23-Nov-20	Conductivity (µs/cm)		80											
24-Nov-20	Conductivity (µs/cm)			73	71	63	61							
25-Nov-20	Conductivity (µs/cm)							60	73	71	70	71	70	67
5-Nov-20	Temperature (°C)								24.74	24.97	25.05	25.17	25.77	25.97
6-Nov-20	Temperature (°C)			27.78	27.47	27.31	26.91	26.37						
10-Nov-20	Temperature (°C)			26.82	26.83	26.84								
11-Nov-20	Temperature (°C)		24.8				26.37	26.55						
12-Nov-20	Temperature (°C)								24.56	24.47	24.66	24.62	25.05	25.5
17-Nov-20	Temperature (°C)			27.35	27.26	26.66	26.2							
18-Nov-20	Temperature (°C)							26.01	24.6	24.73	24.68	24.85	25.27	25.57
23-Nov-20	Temperature (°C)		24.5											
24-Nov-20	Temperature (°C)			28.41	27.76	27.24	27.2							
25-Nov-20	Temperature (°C)							26.64	24.39	24.6	25.14	25.97	26.35	26.55
5-Nov-20	Turbidity (NTU)								2.64	3.07	25.05	9.8	8.04	5.81
6-Nov-20	Turbidity (NTU)			2.96	2.25	2.11	2.24	2.05						
10-Nov-20	Turbidity (NTU)			3.45	3.08	2.39								

		River Name	Nam Ngiep											
		Zone	Location Refer to Construction Sites											
			Upstream/Main Reservoir						Within / Re-regulation Reservoir		Downstream			
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08
Date	Parameters (Unit)	Guideline												
10-Nov-20	Turbidity (NTU)-Hypolimnion					6.94								
11-Nov-20	Turbidity (NTU)		4.02				2.54	2.2						
11-Nov-20	Turbidity (NTU)-Hypolimnion						10.08	9.05						
12-Nov-20	Turbidity (NTU)								2.37	2.77	3.45	4.68	3.63	5.79
17-Nov-20	Turbidity (NTU)			2.33	1.26	1.9	1.79							
18-Nov-20	Turbidity (NTU)							2.01	2.69	3.13	3.87	4.24	3.17	4.93
23-Nov-20	Turbidity (NTU)		4.65											
24-Nov-20	Turbidity (NTU)			2.14	1.66	1.5	1.48							
25-Nov-20	Turbidity (NTU)							1.37	2.02	2.26	1.82	2.23	2.71	3.52
10-Nov-20	TSS (mg/L)		6.47	<5		<5								
10-Nov-20	TSS (mg/L)-Hypolimnion					7.35								
11-Nov-20	TSS (mg/L)						<5	<5						
11-Nov-20	TSS (mg/L)-Hypolimnion						<5	<5						
12-Nov-20	TSS (mg/L)								<5	<5	<5	<5	5.2	14.2
10-Nov-20	BOD <sub>5</sub> (mg/L)	<1.5		1.71		2.8								
10-Nov-20	BOD <sub>5</sub> (mg/L)-Hypolimnion					3.6								
11-Nov-20	BOD <sub>5</sub> (mg/L)	<1.5	<1				1.8	2.1						
11-Nov-20	BOD <sub>5</sub> (mg/L)-Hypolimnion						13.9	13.72						
12-Nov-20	BOD <sub>5</sub> (mg/L)	<1.5							2.06	2.08	2.14	1.4	<1	<1
10-Nov-20	COD (mg/L)	<5.0												
11-Nov-20	COD (mg/L)	<5.0	6.6											
12-Nov-20	COD (mg/L)	<5.0							8.2	12.9	8	8.2	8.8	6.8
10-Nov-20	NH <sub>3</sub> -N (mg/L)	<0.2		<0.2		<0.2								
10-Nov-20	NH <sub>3</sub> -N (mg/L)-Hypolimnion					<0.2								
11-Nov-20	NH <sub>3</sub> -N (mg/L)	<0.2	<0.2				<0.2	<0.2						
11-Nov-20	NH <sub>3</sub> -N (mg/L)-Hypolimnion						0.83	0.58						
10-Nov-20	NO <sub>3</sub> -N (mg/L)	<5.0		<0.02		<0.02								
10-Nov-20	NO <sub>3</sub> -N (mg/L)-Hypolimnion					0.08								

		River Name	Nam Ngiep											
		Zone	Location Refer to Construction Sites											
			Upstream/Main Reservoir						Within / Re-regulation Reservoir		Downstream			
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08
Date	Parameters (Unit)	Guideline												
11-Nov-20	NO <sub>3</sub> -N (mg/L)	<5.0	<0.02				<0.02	<0.02						
11-Nov-20	NO <sub>3</sub> -N (mg/L)-Hypolimnion						<0.02	<0.02						
10-Nov-20	Faecal coliform (MPN/100 mL)	<1,000		13		4.5								
10-Nov-20	Faecal coliform (MPN/100 mL)-Hypolimnion					0								
11-Nov-20	Faecal coliform (MPN/100 mL)	<1,000	140				26	0						
11-Nov-20	Faecal coliform (MPN/100 mL)-Hypolimnion						0	0						
12-Nov-20	Faecal coliform (MPN/100 mL)	<1,000							4	33	46	110	220	
10-Nov-20	Total Coliform (MPN/100 mL)	<5,000	11	13		5								
10-Nov-20	Total Coliform (MPN/100 mL)-Hypolimnion					0								
11-Nov-20	Total Coliform (MPN/100 mL)	<5,000					0	0						
11-Nov-20	Total Coliform (MPN/100 mL)-Hypolimnion						0	0						
12-Nov-20	Total Coliform (MPN/100 mL)	<5,000							0	2	5	26	22	
10-Nov-20	TKN			<1.5		<1.5								
10-Nov-20	TKN-Hypolimnion					<1.5								
11-Nov-20	TKN		<1.5				<1.5	<1.5						
11-Nov-20	TKN-Hypolimnion						<1.5	<1.5						
10-Nov-20	TOC (mg/L)													
11-Nov-20	TOC (mg/L)		0.9											
12-Nov-20	TOC (mg/L)								0.97	1.22	1.21	1.14	1.09	
10-Nov-20	Phytoplankton Biomass (g dry wt/m³)			1.6		1.4								
10-Nov-20	Phytoplankton Biomass (g dry wt/m³)-Hypolimnion					6.4								
11-Nov-20	Phytoplankton Biomass (g dry wt/m³)						1.4	19.2						
11-Nov-20	Phytoplankton Biomass (g dry wt/m³)-Hypolimnion						0.2	9.2						

		River Name	Nam Ngiep											
		Zone	Location Refer to Construction Sites											
			Upstream/Main Reservoir						Within / Re-regulation Reservoir		Downstream			
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08
Date	Parameters (Unit)	Guideline												
10-Nov-20	Total Phosphorus (mg/L)			<0.01		<0.01								
10-Nov-20	Total Phosphorus (mg/L)- Hypolimnion					<0.02								
11-Nov-20	Total Phosphorus (mg/L)		<0.01				<0.01	<0.01						
11-Nov-20	Total Phosphorus (mg/L)- Hypolimnion						<0.01	0.05						
10-Nov-20	Total Dissolved Phosphorus (mg/L)			<0.01		<0.01								
10-Nov-20	Total Dissolved Phosphorus (mg/L)- Hypolimnion					<0.01								
11-Nov-20	Total Dissolved Phosphorus (mg/L)		<0.01				<0.01	<0.01						
11-Nov-20	Total Dissolved Phosphorus (mg/L)- Hypolimnion						<0.01	0.04						
10-Nov-20	Hydrogen Sulfide (mg/L)			<0.02		<0.02								
10-Nov-20	Hydrogen Sulfide (mg/L)- Hypolimnion					<0.02								
11-Nov-20	Hydrogen Sulfide (mg/L)						<0.02	<0.02						
11-Nov-20	Hydrogen Sulfide (mg/L)- Hypolimnion						0.03	0.08						

**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				
5-Nov-20	pH	5.0 - 9.0			6.72	6.85
6-Nov-20	pH	5.0 - 9.0				
10-Nov-20	pH	5.0 - 9.0		7.91		
11-Nov-20	pH	5.0 - 9.0	7.67			
12-Nov-20	pH	5.0 - 9.0			7.48	7.71
17-Nov-20	pH	5.0 - 9.0				
18-Nov-20	pH	5.0 - 9.0			7.89	6.76
23-Nov-20	pH	5.0 - 9.0	7.88			
24-Nov-20	pH	5.0 - 9.0				
25-Nov-20	pH	5.0 - 9.0			7.22	7.33
5-Nov-20	Sat. DO (%)				79	78.8
6-Nov-20	Sat. DO (%)					
10-Nov-20	Sat. DO (%)			102.2		
11-Nov-20	Sat. DO (%)		95.5			
12-Nov-20	Sat. DO (%)				86.5	79.4
17-Nov-20	Sat. DO (%)					
18-Nov-20	Sat. DO (%)				79.8	80.7
23-Nov-20	Sat. DO (%)		102.6			
24-Nov-20	Sat. DO (%)					
25-Nov-20	Sat. DO (%)				91.9	94.6
5-Nov-20	DO (mg/L)	>6.0			6.48	6.54
6-Nov-20	DO (mg/L)	>6.0				
10-Nov-20	DO (mg/L)	>6.0		9.3		
11-Nov-20	DO (mg/L)	>6.0	7.96			
12-Nov-20	DO (mg/L)	>6.0			7.23	6.8
17-Nov-20	DO (mg/L)	>6.0				
18-Nov-20	DO (mg/L)	>6.0			6.54	6.59
23-Nov-20	DO (mg/L)	>6.0	8.29			
24-Nov-20	DO (mg/L)	>6.0				
25-Nov-20	DO (mg/L)	>6.0			7.46	7.76
5-Nov-20	Conductivity (µs/cm)				103	32
6-Nov-20	Conductivity (µs/cm)					
10-Nov-20	Conductivity (µs/cm)			64		
11-Nov-20	Conductivity (µs/cm)		19.82			
12-Nov-20	Conductivity (µs/cm)				104	35
17-Nov-20	Conductivity (µs/cm)					
18-Nov-20	Conductivity (µs/cm)				105	38
23-Nov-20	Conductivity (µs/cm)		29.8			
24-Nov-20	Conductivity (µs/cm)					
25-Nov-20	Conductivity (µs/cm)				112	43
5-Nov-20	Temperature (°C)				25.42	24.86
6-Nov-20	Temperature (°C)					
10-Nov-20	Temperature (°C)			20.13		
11-Nov-20	Temperature (°C)		22.1			
12-Nov-20	Temperature (°C)				24.33	23.05
17-Nov-20	Temperature (°C)					
18-Nov-20	Temperature (°C)				25.35	24.32
23-Nov-20	Temperature (°C)		23.8			

		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				
24-Nov-20	Temperature (°C)					
25-Nov-20	Temperature (°C)				25.77	25.33
5-Nov-20	Turbidity (NTU)				4.55	11.12
6-Nov-20	Turbidity (NTU)					
10-Nov-20	Turbidity (NTU)			3.87		
11-Nov-20	Turbidity (NTU)		6.68			
12-Nov-20	Turbidity (NTU)				4.24	3.38
17-Nov-20	Turbidity (NTU)					
18-Nov-20	Turbidity (NTU)				4.68	3.82
23-Nov-20	Turbidity (NTU)		2.56			
24-Nov-20	Turbidity (NTU)					
25-Nov-20	Turbidity (NTU)				4.03	2.69
10-Nov-20	TSS (mg/L)			<5		
11-Nov-20	TSS (mg/L)		<5			
12-Nov-20	TSS (mg/L)				<5	<5
10-Nov-20	BOD <sub>5</sub> (mg/L)	<1.5		1.16		
11-Nov-20	BOD <sub>5</sub> (mg/L)	<1.5	<1			
12-Nov-20	BOD <sub>5</sub> (mg/L)	<1.5			<1	<1
10-Nov-20	COD (mg/L)	<5.0		10.8		
11-Nov-20	COD (mg/L)	<5.0	12.9			
12-Nov-20	COD (mg/L)	<5.0			6.8	8.4
10-Nov-20	NH <sub>3</sub> -N (mg/L)	<0.2		<0.2		
11-Nov-20	NH <sub>3</sub> -N (mg/L)	<0.2	<0.2			
10-Nov-20	NO <sub>3</sub> -N (mg/L)	<5.0		0.04		
11-Nov-20	NO <sub>3</sub> -N (mg/L)	<5.0	0.03			
10-Nov-20	Faecal coliform (MPN/100 mL)	<1,000		540		
10-Nov-20	Faecal coliform (MPN/100 mL)-Hypolimnion					
11-Nov-20	Faecal coliform (MPN/100 mL)	<1,000	94			
11-Nov-20	Faecal coliform (MPN/100 mL)-Hypolimnion					
12-Nov-20	Faecal coliform (MPN/100 mL)	<1,000			920	540
10-Nov-20	Total Coliform (MPN/100 mL)	<5,000		240		
11-Nov-20	Total Coliform (MPN/100 mL)	<5,000	33			
12-Nov-20	Total Coliform (MPN/100 mL)	<5,000			33	33
10-Nov-20	TKN			<1.5		
11-Nov-20	TKN		<1.5			
10-Nov-20	TOC (mg/L)			0.79		
11-Nov-20	TOC (mg/L)		1.06			
12-Nov-20	TOC (mg/L)				1.09	1.5
10-Nov-20	Total Phosphorus (mg/L)			0.02		
11-Nov-20	Total Phosphorus (mg/L)		<0.01			
10-Nov-20	Total Dissolved Phosphorus (mg/L)			<0.1		
11-Nov-20	Total Dissolved Phosphorus (mg/L)		<0.01			

## ANNEX B: RESULTS OF EFFLUENT ANALYSES

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

	Site Name	OSOV1 (Owner's Site Office and Village)		OSOV2 (ESD Camp)		Main Powerhouse	
	Station Code	EF01		EF13		EF19	
	Date	03-Nov-20	16-Nov-20	03-Nov-20	16-Nov-20	03-Nov-20	16-Nov-20
Parameters (Unit)	Guideline						
pH	6.0 - 9.0	7.39	6.61	6.93	6.62	7.54	7.2
Sat. DO (%)		50.8	43.1	30.3	16.5	39.9	22.8
DO (mg/L)		3.89	3.43	2.02	1.29	2.95	1.76
Conductivity (µs/cm)		404	285	351	540	805	734
TDS (mg/L)		202	142.5	175.5	270	402	367
Temperature (°C)		27.9	25.6	27.9	26.4	29.8	27.4
Turbidity (NTU)		2.57	2.54	16.25	16.76	6.66	6.56
TSS (mg/L)	<50	<5	<5	67.1	45.8	19.0	61.2
BOD <sub>5</sub> (mg/L)	<30	<6	7.26	21.24	<6	<6	<6
COD (mg/L)	<125	<25	<25	44	52	36.8	54.9
NH <sub>3</sub> -N (mg/L)	<10.0	2	<2	16.3	9.8	18.9	21.5
Total Nitrogen (mg/L)	<10.0	6.2	1.02	24	10.5	29.5	27.1
Total Phosphorus (mg/L)	<2	<1	1	1.24	1.24	3.31	2.8
Oil & Grease (mg/L)	<10.0	1.02		5		<1	
Total coliform (MPN/100 mL)	<400	240	47	920	0	0	0
Faecal Coliform (MPN/100 mL)	<400	0	7	920	0	0	0
Effluent Discharge Volume (L/mn)		6	6	8	2	1000	1000
Chlorination Dosing Rate (mL/mn)		n/a	n/a	10	18	250	250
Residual Chlorine (mg/L)	<1.0	n/a	n/a	0.08	1.05	2.20	1.10