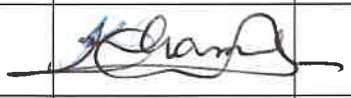
NAM NGIEP 1
POWER COMPANY

Nam Ngiep 1 Hydropower Project

Environmental Management Monthly Monitoring Report

March 2021

					
A	15 April 2021	Hendra WINASTU	Wanidaporn RODE	Khamlar PHONSAVAT	Final
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EXECUTIVE SUMMARY

The preparation and review of the ISO 14001:2015 documentation is ongoing. The training on ISO14001:2015 Internal Audit is postponed to the 4th week of April 2021 awaiting completion of the relevant documents. A short-term ISO document preparation consultant (2-month contract) is required to support preparation of documents. The consultant is expected to start the work by the middle of April 2021.

During March 2021, EMO received three documents (DWP and SS-ESMMPs) for review and approval.

Two Site Inspection Reports (SIRs) were issued to the relevant Contractors of Phouhomxay Village Irrigation Canal Rock and Spoil Disposal area and LILAMA10 camp requesting them to implement additional measures to assure effective revegetation of the decommissioned sites. The VSP Contractor completed additional topsoil cover at the Phouhomxay Village Irrigation Canal Rock and Spoil Disposal area, but no action was taken by the HM Hydro contractor for the LILAMA1 camp.

The evaluation and selection of the contractor for wastewater treatment system improvement and modification is ongoing. It is expected that a qualified contractor will be on board by early April 2021.

In March 2021, Dissolved Oxygen (DO) levels at the surface of the main reservoir were generally between 7 mg/L and 10 mg/L which was similar to February 2021. In the re-regulation reservoir, the DO levels were below 3 mg/L in the whole water column.

During the first half of March 2021, the discharge from the re-regulation dam mainly went through the turbine and occasionally through the gate, and mainly through the gate during the second half of the month. The DO levels during the gate discharge were greater than 6 mg/L at the stations in Nam Ngiep immediately downstream of the Re-regulation Dam and complied with the GOL Standard. No dead fish was observed in Nam Ngiep downstream during this monitoring period. NNP1PC is still in the process of collecting information to assist in developing measures to improve the DO levels downstream.

In March 2021, a total of 20.4 m^3 of solid waste was disposed of at the NNP1 Project Landfill, an increase of 5.4 m^3 compared with February 2021. A total of 14.9 m^3 of solid waste from Phouhomxay, Thahuea and Hat Gniun Villages was disposed of at Houay Soup Landfill. There were no recycle waste trade activities in the Community Waste Bank during the reporting period.

The selection of the local waste collection contractors for the project's waste and landfill operation, and the communities' waste and Houay Soup landfill operation are still ongoing. It is expected that a qualified contractor will be on board by early April 2021.

The reservoir patrolling under NNP1 WMP by Bolikhamxay WRPO continued in March 2021. Biodiversity offset related activities under the components of law enforcement, community outreach, and conservation linked livelihood in the NC-NX offset site continued in March 2021.

The fish catch monitoring for February 2021 in Nam Ngiep watershed was dominated by *Oreochromis niloticus*, *Channa striata* and *Scaphiodonichthys acanthopterus* and species groups of

Poropuntius and Hampala that are classified as Least Concern (LC) according to the IUCN Red List, except *Scaphiodonichthys acanthopterus* is classified as Data Deficient species (DD).

1. ENVIRONMENTAL MANAGEMENT MONITORING

1.1 ENVIRONMENTAL MANAGEMENT SYSTEM (EMS)

The preparation and review of the ISO 14001:2015 documentation is ongoing. The training on ISO14001:2015 Internal Audit is postponed to the 4th week of Apr 2021 awaiting completion of the relevant documents. A short-term ISO document preparation consultant (2-month contract) is required to support preparation of documents. The consultant is expected to start the work by the middle of April 2021.

TABLE 1-1: ENVIRONMENTAL MANAGEMENT SYSTEM WORK PLAN-REVISED IN MARCH 2021

Item	ISO14001:2015 Work Plan	Year 2020		Year 2021			
		Q3	Q4	Q1	Q2	Q3	Q4
1	Continue to prepare EMS documents						
2	**NNP1PC Environmental Policy announcement**						
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 – **1st Stage** (***remote audit*** on the documentation review)						
10	Implement the corrective actions and preventive actions according to the 1st Stage Audit						
11	ISO 14001:2015 Assessment and Certification Audit – **2nd Stage** (***on-site audit***)						
12	Implement the corrective actions and preventive actions according to the 2nd Stage Audit						
13	**Certify of ISO14001:2015 upon successful completion of the audit**						

	Completed activities per the original plan
	Delayed activities and postponed from the previous quarter
	Originally planned activities

1.2 COMPLIANCE MANAGEMENT

In March 2021, EMO received 03 Detail Work Programs (DWPs) and Site Specific Environmental and Social Monitoring and Management Plans (SS-ESMMPs) for review and approval. The status of documents review is presented in ***Table 1-2***.

TABLE 1-2: SS-ESMMP AND DOCUMENT REVIEW STATUS IN MARCH 2021

Title	Date Received	Status
DWP & SS-ESMMP for Filling Void at Main Powerhouse Tailrace	25 March 2021 (2nd submission)	Objection with comments on 30 March 2021. The contractor was guided on revising the documents and re-submit.
DWP & SS-ESMMP for Road DBST repairing	17 March 2021 (1st submission)	No objection with comments on 18 March 2021.
DWP and SS-ESMMP for the Monitoring Works on the NNP1 Project	23 March 2021 (1st submission)	No objection with no comment on 24 March 2021.

There were two Observations of Non-Compliance issued during March 2021. The status of compliance reports (Observation of Non-Compliance or ONC, Non-Compliance Report or NCR) issued by NNP1PC is summarized in ***Table 1-3*** and the status of the ONCs and NCRs that are unsolved exceeding deadlines are presented in ***Table 1-4.***

TABLE 1-3: SUMMARY OF ONCS AND NCRS

Items	ONC	NCR-1	NCR-2	NCR-3
Carried over from February 2021	3	2	0	0
Newly Opened in March 2021	2	0	0	0
Total in Mach 2020	**5**	**2**	**0**	**0**
Resolved in March 2021	4	2	0	0
Carried over to April 2021	1	**0**	0	0
Unsolved Exceeding Deadlines	**1**	**0**	**0**	**0**

TABLE 1-4: SUMMARY OF THE ONCS AND NCRS THAT ARE UNSOLVED EXCEEDING DEADLINES

Document Number / Date of Issue	Subject Description	Current Status at the end of February 2021
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 the mission in August 2019 to improve the OSOV's WWTS)	The selection of a qualified contractor selection is expected to be completed by early April 2021.

1.2.1 Site Inspection by Environment Management Unit (EMU)

The monthly site visit by the EMU of Bolikhan District and the quarterly site visit by the EMU of Xaysomboun Province were not carried out in March 2021.

1.2.2 Site Decommissioning and Rehabilitation

Referring to the site inspection results and comments of Bolikhan District's Environmental Management Unit (EMU) monthly site visit on 20 January 2021, the EMU accepted (with no comments) the rehabilitation of 30 sites out of a total of 32 sites used by the project. The EMU did not accept two sites (Phouhomxay Village's Irrigation canal rock and spoil disposal area and LILAMA10 camp) due to the low percentage of vegetation cover and the EMU requested that additional measures to aid the natural growth of vegetation be carried out.

On 02 February 2021, the VSP contractor completed topsoil covering at the Phouhomxay Village's Irrigation Canal Rock and Spoil Disposal area.

In Mach 2021, NNP1 TD-O&M informed that the HM Hydro Contractor for LILAMA10 camp disagreed to conduct additional measures and claimed that the site was a disturbed area before the Contractor took possession of the land and established their labour camp.

FIGURE 1-1: PHOTOS OF THE TWO SITES WHERE PRESENT LOW PERCENTAGE OF VEGETATION IN MARCH 2021

HM HYDRO LABOUR CAMP NO.2 (LILAMA10 CAMP)	PHX VILLAGE IRRIGATION CANAL ROCK/SPOIL DISPOSAL AREA
	

1.3 ENVIRONMENTAL QUALITY MONITORING

The analyses of Total Suspended Solids (TSS), Biochemical Oxygen Demand (BOD_5), 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/

1.3.1 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 March 2021 indicated non-compliances for some parameters in OSOV1 (EF01), 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 1-5.***

TABLE 1-5: STATUS OF CORRECTIVE ACTIONS FOR NON-COMPLIANCES AT WWTSS IN MARCH 2021

Site	Sampling ID	Status	Corrective Actions
OSOV1	EF01	Non-compliance for ammonia nitrogen in the first fortnightly sampling and total nitrogen in both fortnightly samples.	The selection of a qualified Contractor to improve the WWTSs in OSOV1 and the Main Dam as well as modify the WWTS in OSOV2 is under process. The selection of the contractor is expected to be completed and commencing the work in April 2021.
OSOV2	EF13	Non-compliance for COD (second fortnightly sample), total phosphorus (first fortnightly sampling), Ammonia Nitrogen and Total Nitrogen.	
Main Powerhouse	EF19	Non-compliance for Ammonia Nitrogen (second fortnightly sample), Total Phosphorus and Total Nitrogen.	

1.3.2 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 Phouan [NPH01], Nam Xao [NXA01] and Nam Houay Soup [NHS01]).

In addition, weekly depth profile monitoring (pH, DO, conductivity 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 1-2.***

The monitoring results for key parameters (DO, TSS and BOD_5) during March 2021 are presented in ***Table 1-6, Table 1-7*** *and* ***Table 1-8.*** The full set of data for March 2021 is attached in ***Annex A***. In addition, the results for DO are presented as line graphs in ***Figure 1-3***.

Main Reservoir

From 01 to 31 March 2021, the water level in the main reservoir decreased from El. 309.51 m asl to El. 305.31 m asl.

At R05, the station closest to the main dam, as the water temperature increased, the thermocline was clearly observed at a depth interval from about 8 m to 14 m with an average DO concentration of 8.4 mg/L in the upper 8 m varying between 6.7 mg/L and 10.3 mg/L. Sharp decreases in DO concentrations to levels at or below 2 mg/L were measured at depths between 11 m and 14 m corresponding to 18 m above the centre line of the Intake in early March 2021 to 14 m above the centre line by the end of the month - taking into consideration the lowering of the reservoir level over the period.

At R04, the DO levels in the upper 8 m varied between 6.3 mg/L and 10.6 mg/L, and the DO concentrations dropped to below 2 mg/L at a depth of about 11 m.

The DO levels at R03 were recorded between 5.2 mg/L and 8.5 mg/L in the upper 7 m, and at depths between 9 m and 14 m, the DO concentrations dropped below 2 mg/L. A layer of water with slightly higher DO concentrations (average 3 mg/L) was measured at 32 m - 36 m below the surface likely due to inflow of colder oxygen rich water from Nam Phouan (a right-bank tributary to the reservoir upstream R03) The DO levels at R02 were recorded between 6.3 mg/L and 8.8 mg/L in the upper 5 m, and dropped below 2 mg/L at depths around 7.5 m.

At R01, the DO levels were generally between 6.3 mg/L and 8.3 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 mg/L - 50 mg/L.

The BOD_5 measurements at R03, R04 and R05 in the epilimnion were less than 1.0 mg/L. In the hypolimnion, BOD_5 was recorded less than 1.0 mg/L at R03 and R04, and 1.29 mg/L at R05.

Re-regulation Reservoir

In March 2021, the turbine discharges from the main powerhouse varied between 12 and 237 m^3/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 at or below 2 mg/L in the entire water column.

The BOD_5 concentrations in R06 and R07 was 2.8 mg/L and 1.5 mg/L respectively.

Downstream

During March 2021, the discharge from the re-regulation dam mainly went through the turbine and occasionally through the gate.

The DO concentrations at NNG05 about 1.8 km downstream of the re-regulation dam varied between 2.5 mg/L and 3.7 mg/L (average 2.7 mg/L) and gradually increased to between 4.1 mg/L and 5.7 mg/L at NNG07 some 25.9 km from the dam. At NNG08 close to the confluence with the Mekong River (47.2 km from the dam), the DO levels were between 4.7 mg/L and 6.1 mg/L with an average of 5.6 mg/L. No dead fish was observed in Nam Ngiep downstream during this monitoring

period. NNP1PC is still in the process of collecting information to assist in developing measures to improve the DO levels downstream.

The BOD_5 in the downstream station (NNG05) was 2.47 mg/L and complied with the national surface water quality standard.

FIGURE 1-2: SURFACE WATER AND RE-REGULATION RESERVOIR WATER QUALITY MONITORING STATIONS

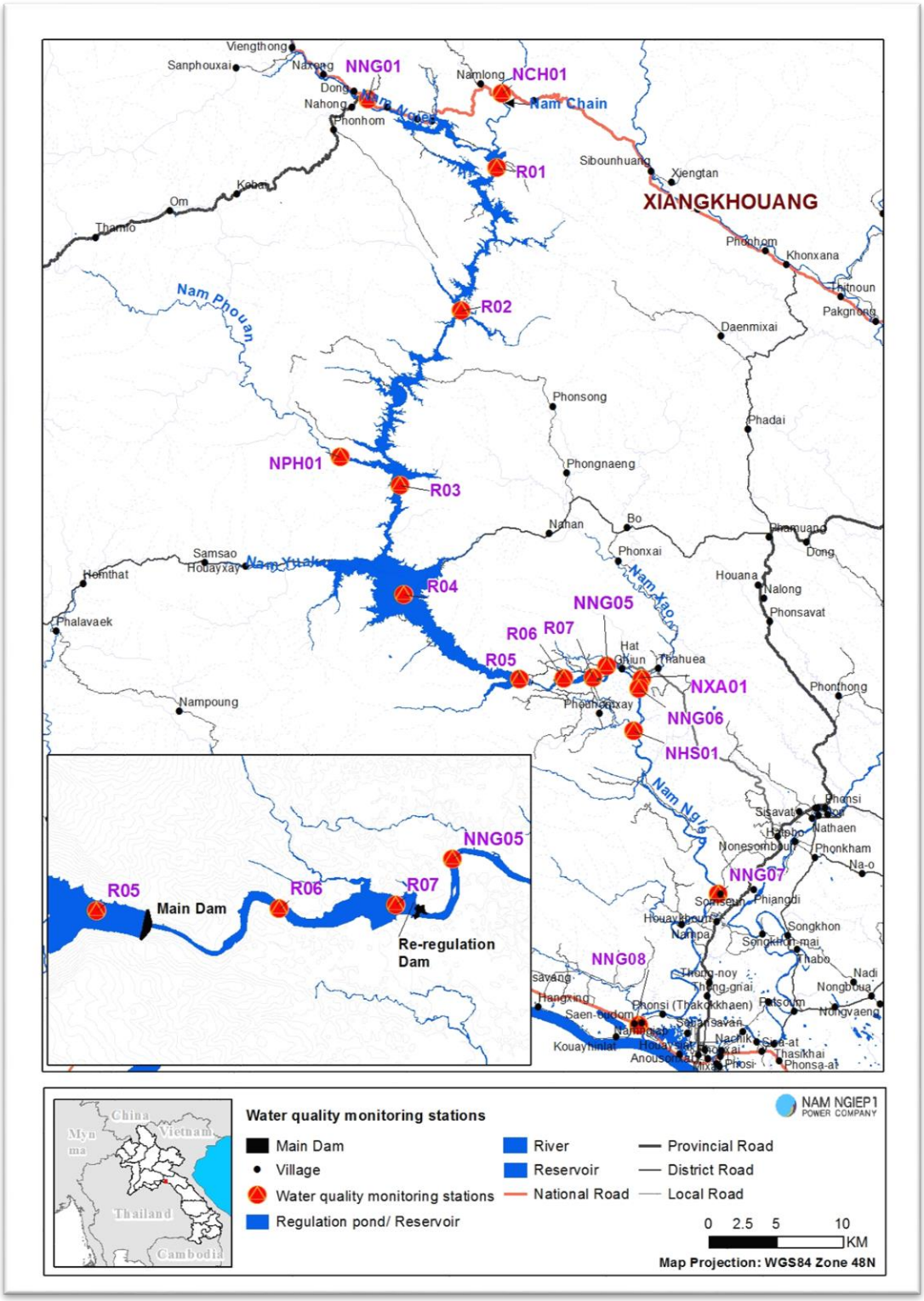


FIGURE 1-3: CONCENTRATION OF DISSOLVED OXYGEN (MG/L) IN THE UPPER 0.2 M SINCE SEPTEMBER 2019 TO MARCH 2021

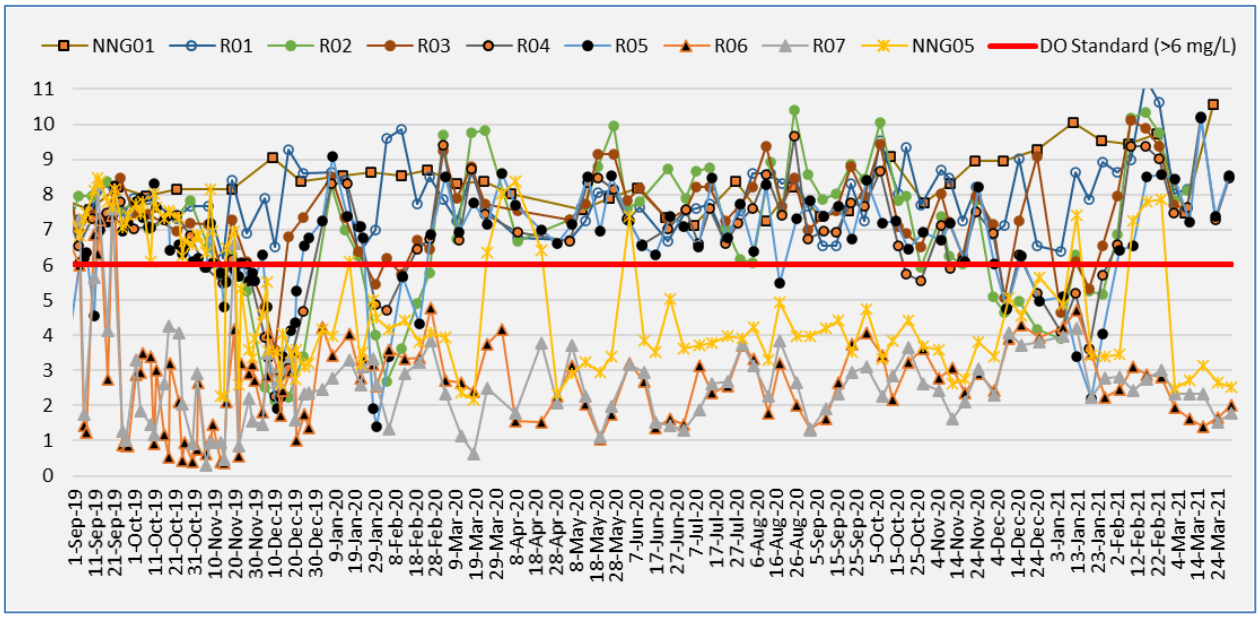


TABLE 1-6: RESULTS OF SURFACE WATER QUALITY MONITORING FOR DISSOLVED OXYGEN (MG/L) IN THE UPPER 0.2 M, NATIONAL WATER QUALITY STANDARD: >6.0 MG/L

DO (mg/L)	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
2-Mar-21		8.02	7.82	7.69	7.48									7.57		
3-Mar-21						8.44	1.96	2.32	2.5	2.83	4.61	5.51			6.32	6.14
8-Mar-21	7.48												8.47			
9-Mar-21		8.16	8.12	7.62	7.63									7.55		
10-Mar-21						7.23	1.61	2.33	2.71	4.62	4.95	5.72			6.16	6.5
16-Mar-21					10.22	10.19										
17-Mar-21							1.39	2.34	3.13	3.21	5.73	6.15			6.41	7.01
22-Mar-21	10.57												8.24			
23-Mar-21					7.3	7.37										
24-Mar-21							1.65	1.53	2.65	4.02	4.45	5.97			6.55	6.14
30-Mar-21					8.48	8.55										
31-Mar-21							2.01	1.79	2.54	2.98	4.12	4.68			5.57	5.41

TABLE 1-7: 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
08-Mar-21	350												<5			
09-Mar-21		<5		<5	<5									<5		
09-Mar-21 Hypolimnion				<5	<5											
10-Mar-21						<5	<5	<5	<5	<5	<5	7.7			<5	<5
10-Mar-21 Hypolimnion						<5										

TABLE 1-8: RESULTS OF SURFACE WATER QUALITY MONITORING FOR BOD_5 (MG/L) - WATER QUALITY STANDARD: < 1.5 MG/L

BOD_5 (mg/L)	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
08-Mar-21	<1												<1			
09-Mar-21		1.48		<1	<1									<1		
09-Mar-21 Hypolimnion				<1	<1											
10-Mar-21						<1	2.84	1.51	2.47	1.72	<1	<1			<1	<1
10-Mar-21 Hypolimnion						1.29										

1.3.3 Groundwater Quality Monitoring

During March 2021, 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 community groundwater samples were taken from household water tap, except in Phouhomxay Village where the groundwater samples were taken at sampling points before entering into the water storage tank.

The results indicate that:

- The two wells in Phouhomxay Village (GPHX01 and GPHX02) complied with the groundwater quality standards for drinking purposes;
- The well in Somsuen Village and one well in ThongNoy Village did not comply with the standards for faecal coliform and *E.coli* bacteria.
- The well in Nam Pa Village complied with the groundwater quality standards parameters monitored.
- The well in Pou Village complied with the groundwater quality standards.

The community groundwater quality monitoring results are presented in ***Table 1-9.***

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.

TABLE 1-9: GROUNDWATER QUALITY MONITORING RESULTS IN SOMSUEN, NAM PA, THONGNOY AND POU VILLAGES

Parameter (Unit)	Site Name	Phouhomxay Village		Somseun Village	Nampa Village	Thongnoy Village	Pou Village
	Station	GPHX01	GPHX02	GSXN01	GNPA01	GTHN01	GPOU01
	Guideline						
pH	6.5 - 9.2	7.68	7.18	6.75	6.83	7.19	7.42
Sat. DO (%)		34.4	25.6	48.2	97.8	68.7	84.4
DO (mg/L)		2.82	2.11	3.8	7.67	5.32	6.59
Conductivity (µS/cm)		185	430	355	400	420	29
Temperature (°C)		25.55	25.07	27.58	27.76	28.63	25.9
Turbidity (NTU)	<20	13.46	3.29	1.91	2.49	1.86	2.58
Faecal coliform (MPN/100mL)		0	0	6.1	0	23	0
E.coli Bacteria (MPN/100mL)	0	0	0	3.7	0	23	0

1.3.4 Gravity Fed Water Supply (GFWS) Quality Monitoring

Although the two new groundwater boreholes *(GPHX01 and GPHX02 – **Table 1-9**)* were connected to the existing water supply tanks commencing on 21 October 2020 *(and as mentioned in Section 1.3.3, these groundwater samples complied with the GOL Drinking Water Standards for all parameters)*, in March 2021, the surface water from Houay Soup Stream is still used occasionally as alternative water supply source for Phouhomxay Village.

The results of the water quality analyses are presented in ***Table 1-10***.

Faecal Coliform and *E.coli* exceeded the drinking water quality standards in the water supply of Thaheua Village (WTHH02), Hat Gnuin Village (WHGN02) and Phouhomxay Village (WPHX02 – Primary School Water Tap and WPHX03 – Household Water Tap). As observed in the field during water sampling, livestock are roaming around the water intake areas and feces from birds may also 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 1-10: 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 - 8.5	7.1	7.31	8.45	8.49
DO (mg/L)		6.49	8.81	7.82	5.85
Conductivity (µS/cm)	<1,000	68	96	25	23
Temperature (°C)	<35	27.12	24.92	25.13	24.84
Turbidity (NTU)	<10	2.5	2.47	2.21	1.79
Faecal Coliform (MPN/100 mL)	0	11	170	280	110
E.coli Bacteria (MPN/100 mL)	0	11	170	280	110

1.3.5 Landfill Leachate Monitoring

During March 2021, landfill leachate monitoring was not conducted at NNP1 Project Landfill and Houay Soup Solid Waste Landfill due to the ponds were dry.

1.4 DISCHARGE MONITORING

1.4.1 Main Reservoir – Water Level, Inflow and Discharge

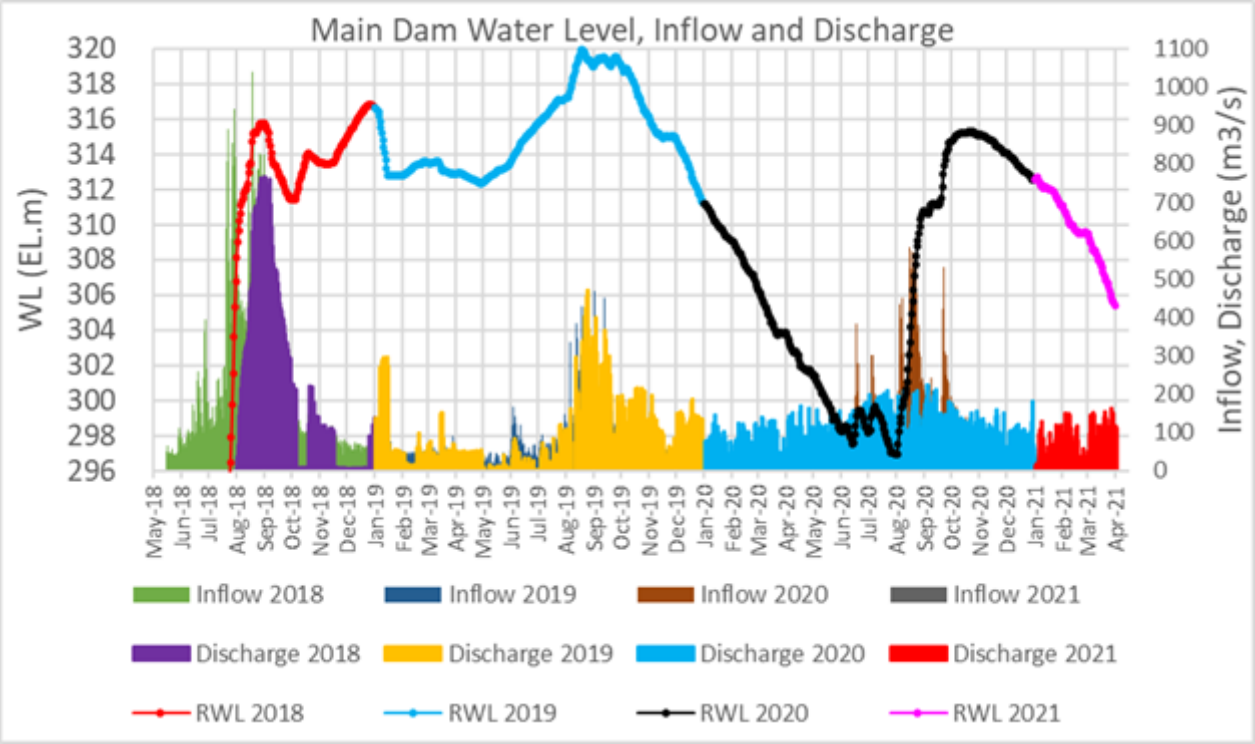
The water level in the main reservoir, inflow to the reservoir and discharge from the reservoir have been monitored since the start of the impounding on 15 May 2018. The graph in ***Figure 1-4*** presents the values recorded since May 2018.

During March 2021, the mean inflow to the main reservoir was 49 m^3/s. The minimum and maximum inflows were 16 (on 09 March 2021) and 67 m^3/s (on 25 March 2021) respectively.

From 01 to 31 March 2021, the water level of the main reservoir decreased by 4.2 m from El. 309.51 m asl to El. 305.31 m asl.

In March 2021, the turbine discharges from the Main Powerhouse varied between 12 and 237 m^3/s usually interrupted by night-time periods with no discharge.

FIGURE 1-4: WATER LEVEL, INFLOW AND DISCHARGE FOR THE MAIN RESERVOIR



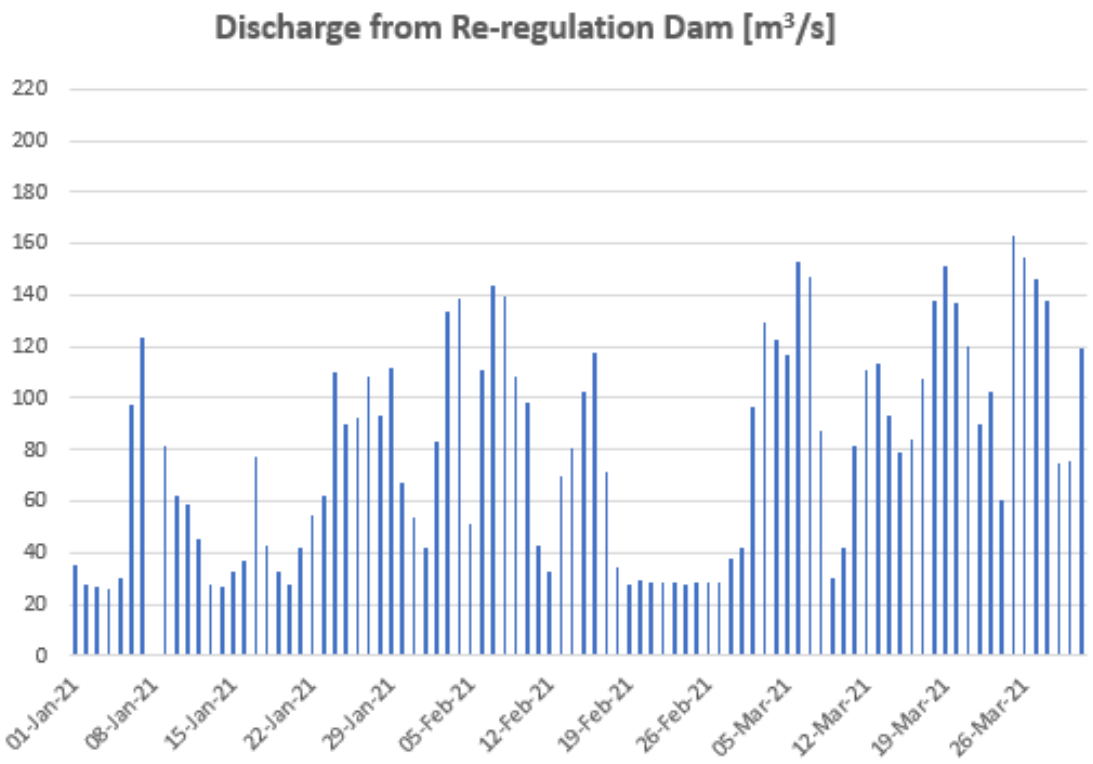
1.4.2 Re-regulation Reservoir – Discharge

The discharge monitoring data for the re-regulation dam during January to March 2021 is presented in ***Figure 1-5***.

During March 2021, the mean discharge from the Re-regulation Dam was about 107 m^3/s with turbine discharges varying between 48 m^3/s and 200 m^3/s, combined with gate discharge varying between 27 m^3/s and 227 m^3/s. The discharge was kept above the minimum flow requirement of 27 m^3/s at all times.

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

FIGURE 1-5: DISCHARGE MONITORING AT THE RE-REGULATION DAM IN JANUARY TO MARCH 2021



1.4.3 Nam Ngiep Downstream Water Depth Monitoring

In March 2021, 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. The boat missions did not encounter any navigation difficulties and the talweg water depths measured during the missions were greater than 0.5 m.

1.5 PROJECT WASTE MANAGEMENT

1.5.1 Solid Waste Management

In March 2021, a total of 20.4 m^3 of solid waste was disposed of at the NNP1 Project Landfill, an increase of 5.4 m^3 compared with February 2021.

A one-year service contract of the local contractor (MH Trading Construction and Trading Export-Import Sole Co., Ltd.) for solid waste management and the project's landfill operation ended on 26 February 2021. During this transition period before the new contractor commences the work, the project general waste collection and disposal was carried out by NNP1PC-ADM.

The selection of the local waste collection contractors for project waste and landfill operation is ongoing. It is expected that a qualified contractor will be on board by early April 2021.

On 20 March 2021, EMO visited a recycle waste and trading company (Phanidtha Export-Import and Environmental Sole Co., Ltd.) in Khounkham District, Khammouance Province to discuss the scope of their services on non-hazardous and hazardous wastes disposal including e-wastes,

reuses, recyclables, and non-recyclables. The company is officially registered to provide the services.

The total amount of recyclable waste collected this month is 404 kg – see ***Table 1-11.***

TABLE 1-11: AMOUNTS OF RECYCLABLE WASTE SOLD

Source and Type of Recycled Waste		Unit	Sold	Cumulative Total by March 2021
1	Plastic bottles	kg	0	80
2	Aluminium	kg	0	39
3	Paper/Cardboard	kg	0	98
4	Glass	kg	0	187
Total		**kg**	**0**	**404**

The villagers from Phouhomxay Village collected a total of 760 kg of food waste from the OSOV1 canteen for animal feed in March 2021, an increase of 280 kg compared with February 2021.

1.5.2 Hazardous Materials and Waste Management

The types and amounts of hazardous material and hazardous waste stored on site in March 2021 are shown in ***Table 1-12 and Table 1-13.***

TABLE 1-12: RECORD OF HAZARDOUS MATERIAL INVENTORY

No.	Type of Hazardous Material	Unit	Total in March 2021 (A)	Used (B)	Remaining at the end of March 2021 (A – B)
1	Diesel	Litre	11,524	5,600	**5,924**
2	Gasoline	Litre	1,369	210	**1,159**
3	Lubricant (Turbine oil)	Litre	7,810	10	**7,800**
4	Colour Paint	Litre	266	16	**250**
5	Thinner	Litre	12	4	**8**
6	Grease Oil	Litre	725	565	**160**
7	Gear Oil	Litre	450	0	**450**
8	Chlorine Liquid	Litre	50	47	**3**
9	Chlorine Powder	kg	65	0	**65**
10	SIKA	Litre	7	0	**7**

TABLE 1-13: RECORD OF HAZARDOUS WASTE INVENTORY

No.	Hazardous Waste Type	Unit	Total in March 2021 (A)	Disposed (B)	Remaining at the end of March 2021 (A - B)
1	Used Oil (Hydraulic and Engine)	Litre	960	0	**960**
2	Used oil mixed with water	Litre	150	0	**150**
3	Empty 200L drum of used oil	Unit	3	1	**2**
4	Contaminated soil, sawdust and textile material	m^3	1.24	0	**1.24**
5	Used tires	Piece	18	0	**18**
6	Empty 20L chemical drum	Drum	10	0	**10**
7	Lead battery	Unit	7	2	**5**
8	Empty paint and spray cans	Can	139	0	**139**
9	Halogen/fluorescent bulbs	Unit	271	5	**266**
10	Empty cartridge (Ink)	Unit	189	0	**189**
11	Clinic Waste	kg	10.5	10	**0.5**

1.6 COMMUNITY WASTE MANAGEMENT

1.6.1 Community Recycling Programme

In March 2021, there was no trading of recyclable waste at the community waste bank. Due to the continuation of COVID-19 measures, many local recycling businesses and vendors have not yet resumed their recyclable waste trading. In addition, there were also less trading activities in the project site and nearby communities due to reduced amounts of recyclable waste after the completion of project construction and decommissioning of the contractors' camps.

The total amount of recyclable waste in the waste bank is 2,519 kg - same as the amount recorded in February 2021.

TABLE 1-14: TYPES AND AMOUNTS OF RECYCLABLE WASTE TRADED AT THE COMMUNITY RECYCLE WASTE BANK

Types of Waste	Unit	Remaining in February 2021	Additional in March 2021	Sold/ dispose	Remaining in March 2021
Glass bottles	kg	2,358	0	0	**2,358**
Paper/ cardboard	kg	126	0	0	**126**
Plastic bottles	kg	35	0	0	**35**
Aluminium cans	kg	0	0	0	**0**
Scrap metal	kg	0	0	0	**0**
Total	**kg**	**2,519**	**0**	**0**	**2,519**

1.6.2 Community Solid Waste Management

In March 2021, approximately 14.9 m^3 of solid waste was collected from Phouhomxay Village and the host villages for disposal at the Houay Soup Landfill, an increase of 0.5 m^3 compared with February 2021.

A one-year service contract of the local contractor (MH Trading Construction and Trading Export-Import Sole Co., Ltd.) for solid waste management and the Houay Soup landfill operation ended on 26 February 2021. During this transition period before the new contractor commences the work, the communities' general waste collection and disposal was supported by NNP1PC EMO and ADM team on a weekly basis.

The selection of the local waste collection contractors for project waste and landfill operation is ongoing. It is expected that a qualified contractor will be on board by early April 2021.

FIGURE 1-6: WASTE MANAGEMENT ACTIVITIES DURING MARCH 2021

THE WASTE COLLECTION FROM THE VILLAGES	*WASTE DISPOSAL AT HOUAY SOP LANDFILL*
	

2. WATERSHED AND BIODIVERSITY MANAGEMENT

2.1 WATERSHED MANAGEMENT

2.1.1 Implementation of Annual Implementation Plan (AIP) 2020

Xaysomboun WRPO submitted a PAFO report on the findings from reservoir patrols conducted during 14 to 22 January 2021. The report highlighted the concerns and issues related to encroachment, resource extraction and illegal fishing in TPZ1 by local people. They also submitted a report from reservoir patrol conducted during 22 February to 02 March 2021.

Xaysomboun WRPO informed that that the construction of sub-office of Xaysomboun WRPO at Ban Houay Xay of Hom District under the approved AIP2020 was started on 23 February 2021. The construction of two patrolling sub-stations and two reservoir check-points will also be done by the same GOL contractor after the completion of sub-office construction. NNP1PC ESD requested Xaysomboun Provincial Governor and Xaysomboun PAFO during the discussion on 12 March 2021

for better coordination on the construction plan, information sharing, and progress of WRPO facilities.

Bolikhamxay WRPO submitted monthly progress reports for January and February 2021. The reports have been reviewed by EMO with some remarks for follow-up.

Bolikhamxay WRPO submitted a report on reservoir patrolling conducted in February 2021 and prepared a report on forest and reservoir patrolling conducted during 02 to 11 March 2021.

The EMO team noted the challenges for WRPO and their Management to understand the important and benefits of the SMART system for the conservation work. The EMO Team is considering the applicability of SMART or other application to support the WRPO patrolling activity. This will be further discussed with WRPOs and BSP Team.

The camera-trap installation within NNP1 watershed TPZ area was scheduled during 26 March to 07 April 2021 with a total of 97 camera-traps in 53 blocks within Xaysomboun Province and 3 camera-traps in two blocks within Bolikhamxay Province. The training for camera trap installation was organized on 24-25 March 2021 to key GOL staff however the field implementation has to be postponed until there is further agreement about the accommodation allowance for the filed work in the remote or forest area

EMO was also exploring the collaboration opportunities with GOL institutions and universities for providing training courses on the land-use and forest resources management to WRPO and GOL staff under Activity 1.4 of the approved NNP1 WMP - Strengthening of institutional capacity of village authorities, WRPO and relevant government agencies related to land use and natural resource management.

The EMO Team sent training needs assessment forms to WRPOs in the first week of March 2021. The assessment will be used for prioritizing the training needs on the knowledge and skill of GOL staffs who are involved in implementing land use and forest management. EMO Team received three completed training needs assessment (land use and forest management) forms from Bolikhamxay WRPO in the third week of March 2021 and continues to follow-up with Xaysomboun and Bolikhamxay WRPO on the submission of remaining assessments.

Following the discussion on the possibility of collaboration in providing the training courses of land-use and forest management for WRPO and GOL staff with professors at Bolikhamxay Agriculture and Forestry College in February 2021, the College submitted a draft budget proposal for four training courses which is being reviewed by EMO Team.

EMO team prepared the ToR for a Short-term Individual Consultant to provide support implementing the Action Plan on Sustainable Livelihood Opportunities under component 6 of the approved WMP. The assessment report and ToR for a Short-term Individual Consultant to provide support implementing the Action Plan of Sustainable Livelihood Opportunities were shared with SMO team to seek the support internally from SMO team instead of hiring the external consultant.

2.1.2 Preparation of Annual Implementation Plan (AIP) 2021

Bolikhamxay WRPO was still improving the draft AIP2021 in March 2021.

A working session between EMO, Xaysomboun WRPO, and BSP was organized on 11 March 2021 focusing on the Component 4 of the approved NNP1 WMP - TPZ biodiversity protection. It is noted that the key priority activities recommended under this component shall include: 1) commencing the TPZ patrol; 2) preparation of law enforcement strategy; and 3) preparation of outreach strategy for conservation work. XSB WRPO confirmed that the draft AIP2021 will be submitted to DOF-MAF

first before further submission to NNP1PC. EMO Team will continue to follow-up with both WRPOs on their AIP2021 finalization.

Following the meeting among DOF-MAF, WRPO, and NNP1PC in January 2021, EMO Team have prepared the 5-year budget plan (2021-2025) of WMP for Xaysomboun and Bolikhamxay WRPO. This plan will serve as the reference for WRPO on the scope of the activities and budget sealing in formulating their AIP. The plan has been reviewed by EMO team and shared to DOF-MAF and the Head of Xaysomboun and Bolikhamxay PAFO/Vice Chairman of WRPC of Xaysomboun and Bolikhamxay as well as BSP Team in the third week of March 2021.

The discussion about allowances for Bolikhamxay WRPO and NC-NX BOMU with the Head of Bolikhamxay PAFO was organized on 03 March 2021. It is noted that the Head of Bolikhamxay PAFO agrees with NNP1PC that the accommodation allowance shall not be provided for regular patrolling work in remote areas that do not have any accommodation according to the MoF Financial Policy. However, it is noted that at the end of March 2021, both Bolikhamxay WRPO and NC-NX BOMU are requesting further consultations with DOF-MAF prior to agreeing with the recommendations put forward by the Head of Bolikhamxay PAFO.

The discussion about allowances and other topics related to Xaysomboun WRPO implementation activities between NNP1PC ESD management, the Xaysomboun Provincial Governor and relevant GOL offices was organized on 12 March 2020 at the XSB Provincial Governor Office in Anouvong. The key remarks from the discussion include:

- Provincial Governor principally agreed with NNP1PC proposal that accommodation allowance as per MoF Policy (No. 4000) should not be applied for activities in remote places that do not have any accommodation.
- It was recommended for the company and WRPC/WRPO to follow the current practice unless a new national financial regulation is issued, which anyway should also be discussed among the relevant parties for its suitability before implementing.
- WRPC/WRPO to inform relevant staffs to avoid impacts on staff performance.
- The decision made on 12 March 2021 should be respected and implemented accordingly. The Governor also encouraged the company to bring any immediate concerns to the attention of the provincial leadership.

2.2 BIODIVERSITY OFFSET MANAGEMENT

2.2.1 Implementation of BOMP Annual Implementation Plan (AIP) 2019 and 2020

The progress on the implementation of key activities by Component in March 2021 are described below:

a. Component 1 - Spatial Planning and Regulation

The TPZ boundary demarcation in the remaining village, Ban Vangphieng of Viengthong district will be further postponed due to the unavailability of NC-NX BOMU and relevant GOL staffs.

b. Component 2 – Law Enforcement

The four patrol teams continued the patrolling between 12 March 2021 and the first week of April 2021 in which three teams focused on TPZ Highest priority area and one team focused on Nam Houng TPZ High priority area. The results of patrolling in March 2021 will be presented and discussed in April 2021 Monthly Report.

The results of patrolling activity in February 2021 are as follows:

Team	Patrolling Area/distance	Observations/Actions Taken
1	TPZ highest priority area including Nam San, Nam Chouan, Nam Sone, Houay Poung and Houay Payang (12 days covering a distance of 68.5 km on forest patrolling)	The team did not encounter any threats during patrolling.
2	TPZ high priority area including Nam Ma, Nam Pang and Nam Ma mountain ridge (15 days covering a distance of 112.8 km on forest patrolling)	The team did not encounter any threats during patrolling but found carcasses of eagle and wild pig at Nam Ma. However, the team was not able to identify the cause of the death.
3	TPZ highest priority area including Nam Chang, Nam Sone and mountain ridge between Nam Sone and Nam Chang (16 days covering a distance of 85 km on forest patrolling and 12 km on road patrolling)	The team did not encounter any threats during patrolling.
4	TPZ highest priority area including Houay Xay Noi, Houay Xay Gnai, Nam Xi, Nam Chouan and ridges (16 days covering a distance of 78 km on forest patrolling and 12 km on road patrolling)	The team did not encounter any threats during patrolling.

c. Component 3 – Conservation Outreach

A meeting with BOMU, Viengthong and Xaychamphone District outreach team was organized on 01 - 04 March 2021 in Viengthong District. The key objectives of the meeting include presenting the results of pre-survey that was conducted in the fourth quarter 2020, development of outreach conceptual modelling, design and prioritize outreach activities, design outreach tools and training on activity implementation. BSP prepared the report on the results of the training activity and the overall scheduled of outreach activity is being updated accordingly. It is noted that the activity was expected to start at the end of April 2021 or the first week of May 2021. BSP also shared the report (Lao) of pre-survey to BOMU and NNP1PC on 12 March 2021.

d. Component 4 – Conservation linked livelihood development

The Lao version of CDP was finalized on 22 February 2021 and submitted to NC-NX BOMU for their final review. The final snare removal plan (Lao version) was shared to BOMU & NNP1 BID on 10 March 2021. The village team establishment in Vangphieng Village was organized during 16 to 19 March 2021 and the training was organized on 23 – 26 March 2021.

e. Component 6 – Biological Monitoring

The draft ToR for Lao Newt and Bent-toe gecko survey in the NNP1 sub catchment, Otter survey in the NC-NX, and fish survey for the sub-catchment and NC-NX were drafted by BSP and have been reviewed by EMO. It is noted per further discussion between EMO and BSP that the biological monitoring matrix will be further updated and shared to ADB and IAP together with the TORs for the surveys. Further procurement of the experts/specialist for the survey under NNP1 NNL fund will be processed after ADB and IAP acknowledgement.

2.2.2 Preparation of Annual Implementation Plan (AIP) 2021

NNP1PC re-submitted the plan to ADB and IAP on 10 March 2021 with response to ADB's comments. The budget plan was approved by ADB and IAP on 18 March 2021. EMO Team has refined the plan and shared it with NC-NX BOMU on 24 March 2021. EMO, NC-NX BOMU, and BSP will further work on the activity schedule and budget partition in quarterly basis prior to finalizing the official document in Lao language and submission of fund disbursement request to NNP1PC.

3. FISHERY MONITORING

Two species groups and three species dominated the fish catch by weight in February 2021 as listed in ***Table 3-1.*** All species are classified as Least Concern (LC) according to the IUCN Red List of Threatened Species, except *Scaphiodonichthys acanthopterus* is classified as Data Deficient species (DD).

Table 3-1*: *Fish Species dominating the Fish Catch in February 2021

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
Hampala dispar, Hampala macrolepidota	ปาสูด	198.6	LC
Oreochromis niloticus	ปานิน	182.4	LC
Poropuntius normani, Poropuntius laoensis, Poropuntius carinatus	ปาจาด	141.3	LC
Scaphiodonichthys acanthopterus	ปาม้อม	62.6	DD
Channa striata	ปาถ่ำ	83.9	LC

The recorded catch of Threatened species (IUCN Red List classification) in February 2021 is presented in ***Table 3-2.*** The list includes three species that are classified as Vulnerable species (VU).

Table 3-2*: *Threatened Species of February 2021 Fish Catch

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
Cyprinus carpio	ปาไน	26	VU
Scaphognathops bandanensis	ปาอ่วนไฟ/ปาป่วน	13.2	VU
Tor sinensis	ปาแดง	29.2	VU

Species abundance and occurrence is based on the 7-day reported catch from the DCL survey in February 2021. The catch is divided in 3 areas including above the main dam, below the main dam and Mekong area. There are 36 species and species groups in the catch above the main dam, while

there are 32 species and species groups for below the main dam and 28 species and species group for Mekong. Main biodiversity indicators in February 2021 for above dam, below dam and Mekong area is presented in ***Table 3-3.***

Table 3-3: Main Biodiversity Indicators for February 2021

	Mekong	Below dam	Above dam
Total species and groups	28	32	36
Single species	21	22	23
Species groups	7	10	13
Top 15 species (% total catch in weight)	94.00%	86.03%	50.63%
Proportion for species groups	15.29%	64.87%	49.44%
Diversity index (Shannon)	2.516	1.829	2.659

In February 2021, the random sampling size of the DCL survey was adjusted to avoid the effect of sampling and reporting bias. ***Figure 3-1*** shows the proportion of total number of households actively fishing by fishing zone including upstream (US), upper reservoir (UR), lower reservoir (LR), downstream (DS) and Mekong (MK). There are more than 50% of active fishing households for all fishing zones in February 2021, but the most is the Mekong area with 90% households fishing.

Figure 3-1: Proportion of total number of households actively fishing by fishing zone

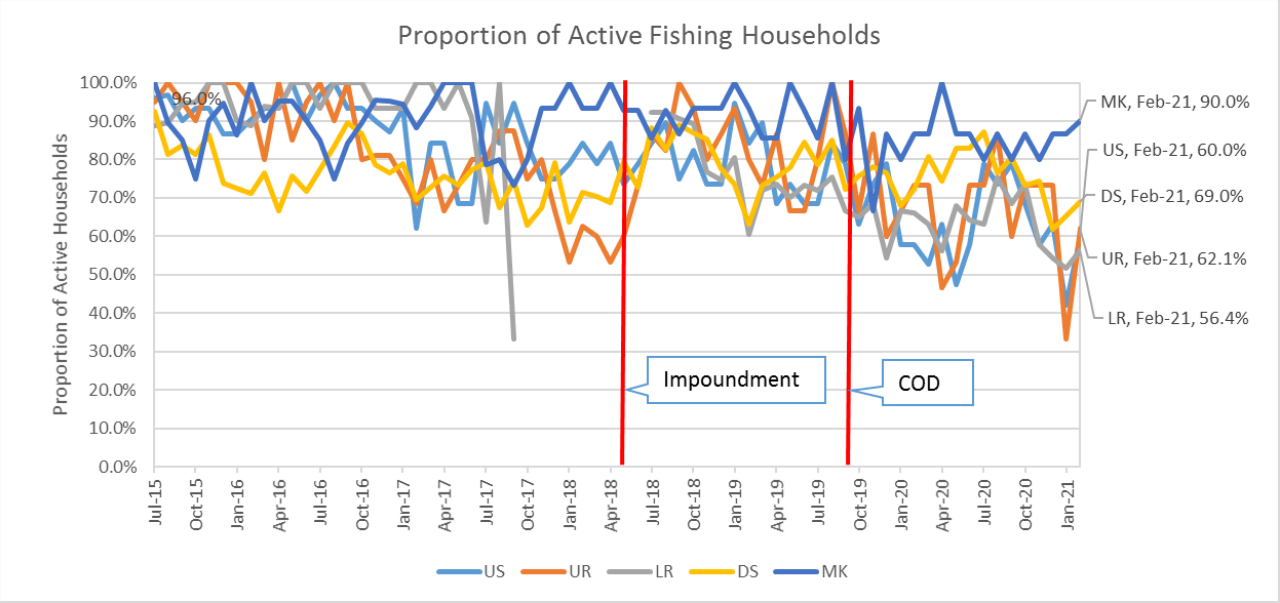
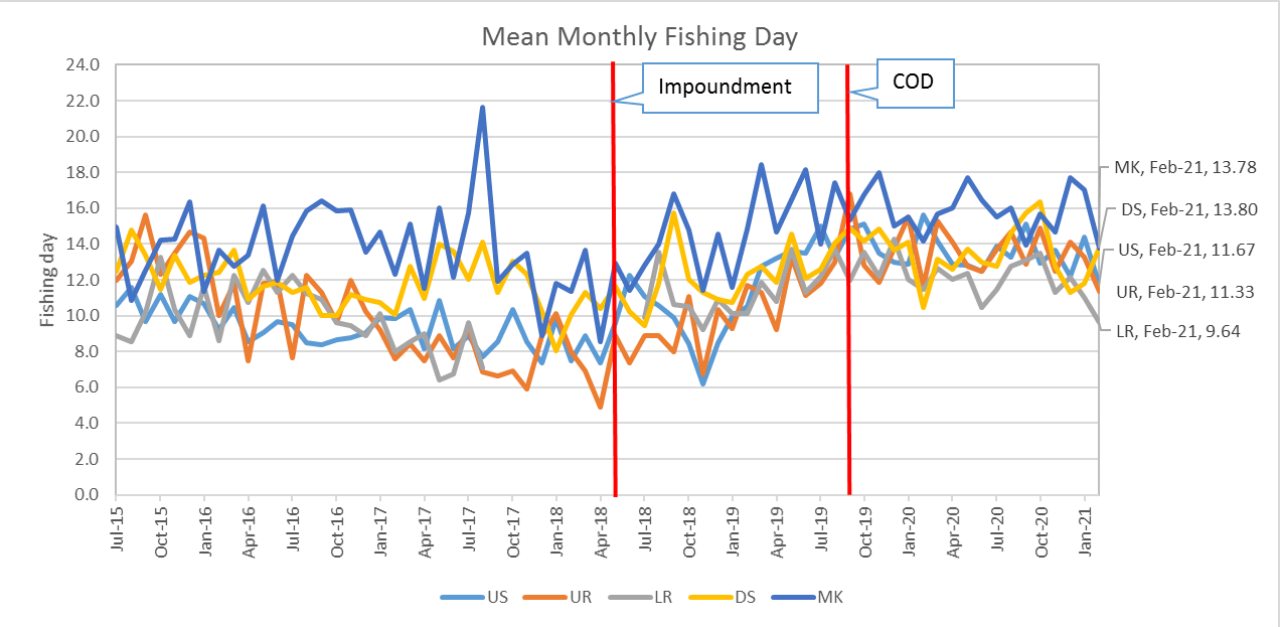


Figure 3-2 shows the average (mean) of monthly fishing day from July 2015 to February 2021 for the upstream (US), upper reservoir (UR), lower reservoir (LR), downstream (DS) and Mekong (MK) area.

Figure 3-2: Mean of monthly fishing day from July 2015 to February 2021



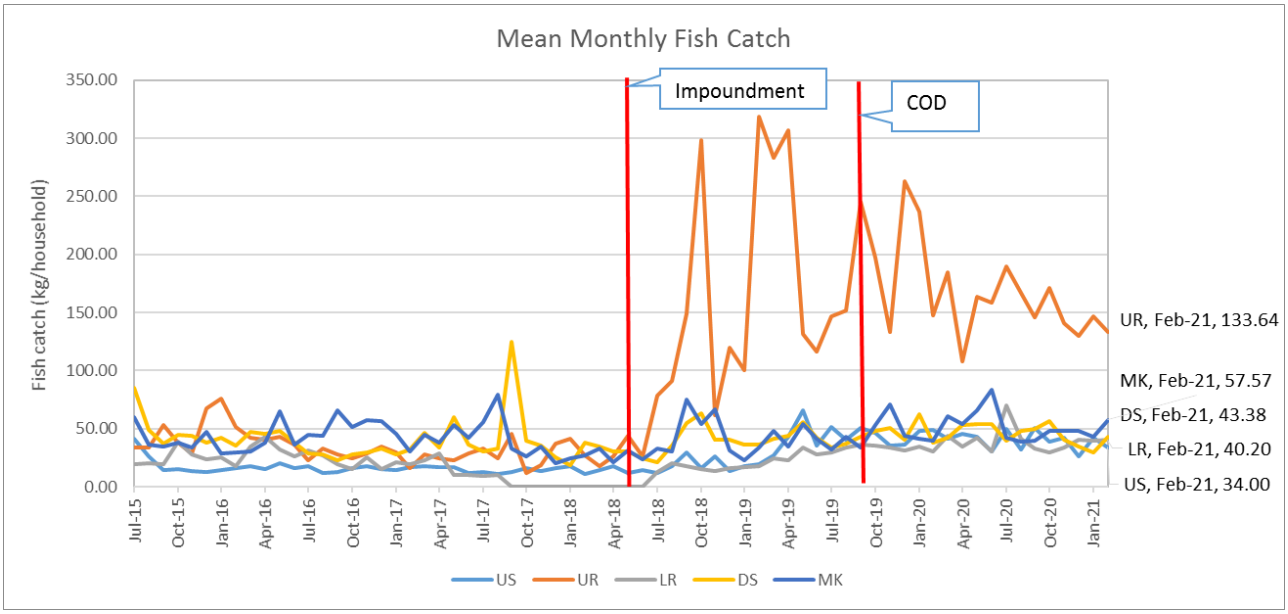
The mean monthly number of fishing day in February from 2016 to 2021 for the upstream, upper reservoir, lower reservoir, downstream and Mekong area are displayed in ***Table 3-4.***

Table 3-4*: *Mean reported number of fishing days by fishing zone in February

Fishing Zone	February 2016 (kg)	February 2017 (kg)	February 2018 (kg)	February 2019 (kg)	February 2020 (kg)	February 2021 (kg)
Upstream	9.23	9.85	9.84	10.50	15.64	11.67
Upper reservoir	9.99	7.60	10.12	11.67	11.64	11.33
Lower reservoir	8.58	8.00	NA	10.13	11.46	9.64
Downstream	12.43	10.06	8.05	12.33	10.47	13.80
Mekong	13.65	12.33	11.81	14.86	14.15	13.78

The mean monthly household fish catch from July 2015 to February 2021 for the upstream (US), upper reservoir (UR), lower reservoir (LR), downstream (DS) and Mekong (MK) area are presented in ***Figure 3-3.***

Figure 3-3: Mean Monthly Household Fish Catch



The mean household fish catch for the month of February from 2016 to 2021 in the upstream, upper reservoir, lower reservoir, downstream and Mekong area are displayed in ***Table 3-5.***

Table 3-5*: *Mean Monthly Household Fish Catch for the month of February from 2016 to 2021

Fishing Zone	February 2016 (kg)	February 2017 (kg)	February 2018 (kg)	February 2019 (kg)	February 2020 (kg)	February 2021 (kg)
Upstream	16.06	16.62	10.95	18.24	49.05	34.00
Upper reservoir	51.66	16.60	26.80	100.49	147.85	133.64
Lower reservoir	17.93	19.35	NA	16.90	30.61	40.20
Downstream	35.79	32.34	38.38	36.36	38.08	43.38
Mekong	29.90	30.73	27.33	23.27	39.57	57.57

The mean daily fish catch per household are displayed in ***Figure 4-3*** and the mean fish catch per household per fishing day for the month of February from 2016 to 2021 are shown in ***Table 3-6.***

Figure 3-4*: *Mean Daily Fish Catch per Household

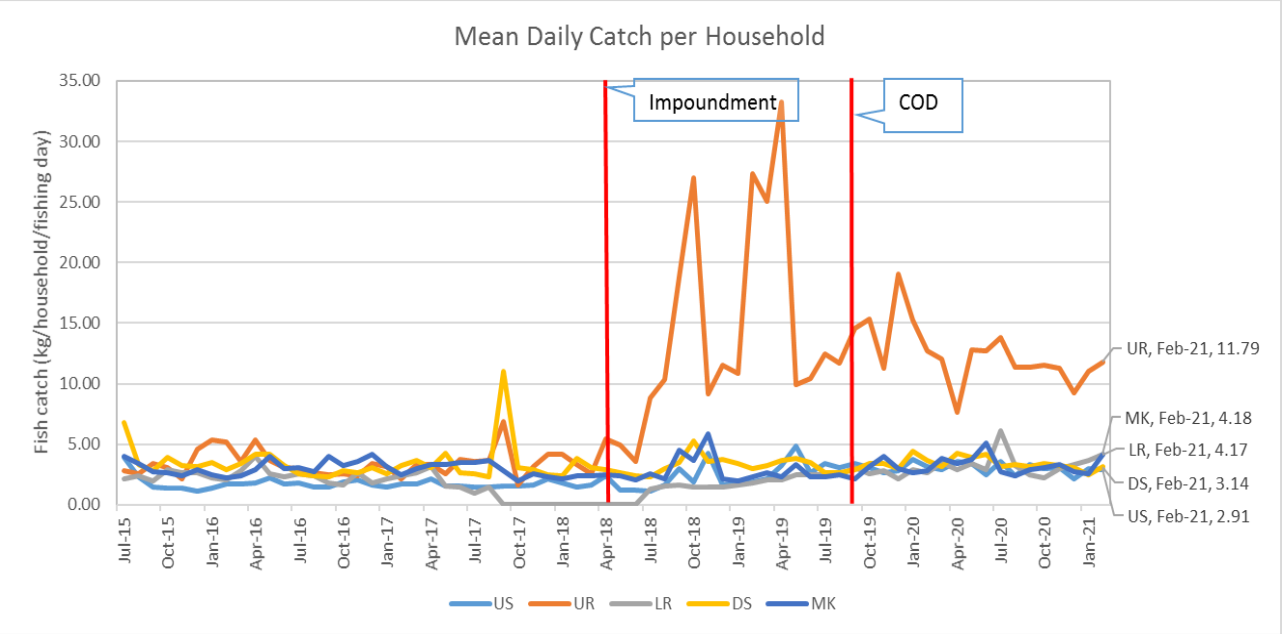


Table 3-6*: *Mean Daily Fish Catch per Household for the month of February from 2016 to 2021

Fishing Zone	February 2016 (kg)	February 2017 (kg)	February 2018 (kg)	February 2019 (kg)	February 2020 (kg)	February 2021 (kg)
Upstream	1.74	1.69	1.46	1.90	3.14	2.91
Upper reservoir	5.17	2.18	3.35	27.32	12.71	11.79
Lower reservoir	2.09	2.42	NA	1.79	2.67	4.17
Downstream	2.88	3.21	3.81	2.96	3.64	3.14
Mekong	2.19	2.49	2.41	2.28	2.80	4.18

The survey results in February 2021 found that tributaries and streams are the main fishing habitat for downstream and lower reservoir zones, while the main fishing habitat in upper reservoir, upstream and Mekong zones are reservoir, Nam Ngiep and Mekong respectively. The proportion of fishing habitats in February 2021 are displayed in ***Table 3-7***.

Table 3-7: Proportion of the catch reported by main habitats (%) in February 2021

Habitats	MK	DS	LR	UR	US
Mekong	89.5%	13.6%	0.0%	0.0%	0.0%
Nam Ngiep	0.0%	30.3%	0.0%	18.1%	55.5%
Nam Xan	0.0%	0.0%	0.0%	0.0%	0.0%
Reservoir	0.0%	0.0%	31.1%	76.0%	0.0%
Tributary and stream	0.0%	56.1%	68.9%	5.9%	42.5%
Wetland	10.5%	0.0%	0.0%	0.0%	2.0%
Others	0.0%	0.0%	0.0%	0.0%	0.0%

Total reported fish and OAA catch (proportion of OAA) for the same 7-day period from July 2015 to February 2021 are presented in ***Figure 3-5*** and the proportion of OAA catch for the month of February from 2016 to 2021 are shown in ***Table 3-8.***

Figure 3-5: Proportion of OAA to the total reported number of fish and OAA for a 7-day period by fishing zone.

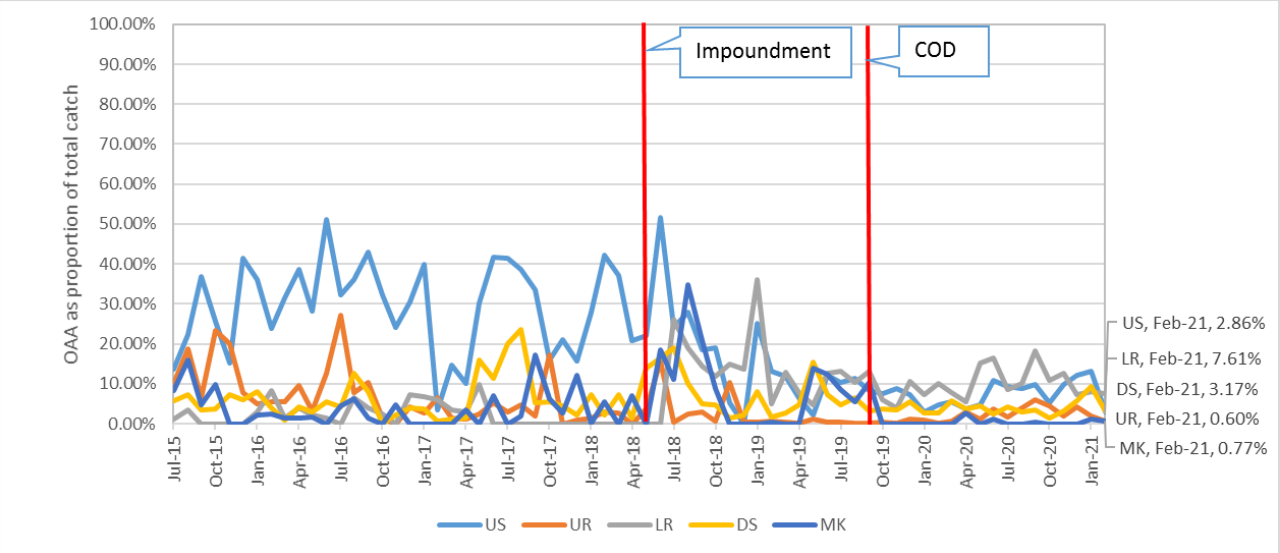


Table 3-8: Proportion of OAA to the total reported number of fish and OAA for the month of February from 2016 to 2021

Fishing Zone	February 2016 (kg)	February 2017 (kg)	February 2018 (kg)	February 2019 (kg)	February 2020 (kg)	February 2021 (kg)
Upstream	23.91%	3.57%	42.22%	13.10%	4.66%	2.86%
Upper reservoir	5.57%	6.53%	2.90%	0.57%	0.07%	0.60%
Lower reservoir	8.18%	5.98%	0.00%	4.86%	10.18%	7.61%
Downstream	3.87%	0.71%	2.13%	1.66%	2.56%	3.17%
Mekong	2.54%	0.00%	5.42%	0.50%	0.00%	0.77%

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												
2-Mar-21	pH	5.0 - 9.0		7.22	7.02	6.76	6.86							
3-Mar-21	pH	5.0 - 9.0						6.49	6.94	6.98	7.09	7.42	7.57	7.8
8-Mar-21	pH	5.0 - 9.0	7.15											
9-Mar-21	pH	5.0 - 9.0		7.36	7.55	7.23	6.95							
10-Mar-21	pH	5.0 - 9.0						6.63	6.91	6.99	7.29	7.39	7.52	7.36
16-Mar-21	pH	5.0 - 9.0					6.31	6.78						
17-Mar-21	pH	5.0 - 9.0							6.87	6.76	6.59	6.94	7.2	7.33
22-Mar-21	pH	5.0 - 9.0	7.06											
23-Mar-21	pH	5.0 - 9.0					6.48	6.62						
24-Mar-21	pH	5.0 - 9.0							6.88	6.95	6.98	6.93	6.75	6.78
30-Mar-21	pH	5.0 - 9.0					6.63	6.72						
31-Mar-21	pH	5.0 - 9.0							6.55	6.84	6.92	7.06	7.3	7.44
2-Mar-21	Sat. DO (%)			101.5	97.6	94.8	91.7							
3-Mar-21	Sat. DO (%)							102.4	22.6	27	29.1	33.1	54.3	65.7
8-Mar-21	Sat. DO (%)		96											
9-Mar-21	Sat. DO (%)			107.5	105.2	95.6	94.5							
10-Mar-21	Sat. DO (%)							88.5	18.6	28.3	31.7	54.9	60	69.6
16-Mar-21	Sat. DO (%)						128.1	126.5						
17-Mar-21	Sat. DO (%)								16.1	27.4	36.2	37.8	68.9	74.6
22-Mar-21	Sat. DO (%)		126.8											
23-Mar-21	Sat. DO (%)						90.9	91.7						
24-Mar-21	Sat. DO (%)								19.3	17.6	30.3	47	49.5	71.3
30-Mar-21	Sat. DO (%)						108.4	109.2						
31-Mar-21	Sat. DO (%)								23.4	20.3	29.7	35.2	49.5	56.2
2-Mar-21	DO (mg/L)	>6.0		8.02	7.82	7.69	7.48							
3-Mar-21	DO (mg/L)	>6.0						8.44	1.96	2.32	2.5	2.83	4.61	5.51
8-Mar-21	DO (mg/L)	>6.0	7.48											
9-Mar-21	DO (mg/L)	>6.0		8.16	8.12	7.62	7.63							
10-Mar-21	DO (mg/L)	>6.0						7.23	1.61	2.33	2.71	4.62	4.95	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)	Guideline												
16-Mar-21	DO (mg/L)	>6.0					10.22	10.19						
17-Mar-21	DO (mg/L)	>6.0							1.39	2.34	3.13	3.21	5.73	6.15
22-Mar-21	DO (mg/L)	>6.0	10.57											
23-Mar-21	DO (mg/L)	>6.0					7.3	7.37						
24-Mar-21	DO (mg/L)	>6.0							1.65	1.53	2.65	4.02	4.45	5.97
30-Mar-21	DO (mg/L)	>6.0					8.48	8.55						
31-Mar-21	DO (mg/L)	>6.0							2.01	1.79	2.54	2.98	4.12	4.68
2-Mar-21	Conductivity (µs/cm)			82	74	68	67							
3-Mar-21	Conductivity (µs/cm)							67	87	82	80	81	77	77
8-Mar-21	Conductivity (µs/cm)		115											
9-Mar-21	Conductivity (µs/cm)			94	74	68	67							
10-Mar-21	Conductivity (µs/cm)							67	85	77	79	79	78	77
16-Mar-21	Conductivity (µs/cm)						68	67						
17-Mar-21	Conductivity (µs/cm)								83	80	79	79	76	76
22-Mar-21	Conductivity (µs/cm)		100											
23-Mar-21	Conductivity (µs/cm)						68	68						
24-Mar-21	Conductivity (µs/cm)								81	79	78	78	75	74
30-Mar-21	Conductivity (µs/cm)						69	68						
31-Mar-21	Conductivity (µs/cm)								78	77	77	77	74	73
2-Mar-21	Temperature (°C)			27.32	26.55	26.01	25.69							
3-Mar-21	Temperature (°C)							25.12	22.87	23.01	23.01	23.32	23.58	23.92
8-Mar-21	Temperature (°C)		26											
9-Mar-21	Temperature (°C)			29.88	28.72	27	26.37							
10-Mar-21	Temperature (°C)							25.6	22.9	24.49	23.65	24.05	24.94	25.33
16-Mar-21	Temperature (°C)						26.91	26.37						
17-Mar-21	Temperature (°C)								22.9	23.22	23.24	23.69	24.46	25.16
22-Mar-21	Temperature (°C)		24.4											
23-Mar-21	Temperature (°C)						26.59	26.5						

		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												
24-Mar-21	Temperature (°C)								22.91	22.93	23.23	23.31	23.87	24.32
30-Mar-21	Temperature (°C)						27.99	28.08						
31-Mar-21	Temperature (°C)								22.96	22.94	23.17	23.5	24.48	24.78
2-Mar-21	Turbidity (NTU)			2.41	1.91	1.62	1.88							
3-Mar-21	Turbidity (NTU)							1.34	1.56	4.02	4.69	5.19	6.13	5.59
8-Mar-21	Turbidity (NTU)		632											
9-Mar-21	Turbidity (NTU)			12.77	1.74	2.85	2.78							
10-Mar-21	Turbidity (NTU)							2.4	1.92	4.96	3.94	4.08	4.19	5.6
16-Mar-21	Turbidity (NTU)						2.06	2.37						
17-Mar-21	Turbidity (NTU)								2.09	4.49	4.72	4.31	3.68	4.83
22-Mar-21	Turbidity (NTU)		6.38											
23-Mar-21	Turbidity (NTU)						2.56	2.94						
24-Mar-21	Turbidity (NTU)								2.34	2.61	2.77	9.67	3.78	5.53
30-Mar-21	Turbidity (NTU)						2.1	2.18						
31-Mar-21	Turbidity (NTU)								1.63	2.81	2.54	2.7	6.63	6.79
8-Mar-21	TSS (mg/L)		350											
9-Mar-21	TSS (mg/L)													
10-Mar-21	TSS (mg/L)													
8-Mar-21	BOD_5 (mg/L)	<1.5	<1											
9-Mar-21	BOD_5 (mg/L)	<1.5		1.48		<1	<1							
10-Mar-21	BOD_5 (mg/L)	<1.5						1.29	2.84	1.51	2.47	1.72	<1	<1
8-Mar-21	COD (mg/L)	<5.0	<5											
9-Mar-21	COD (mg/L)	<5.0												
10-Mar-21	COD (mg/L)	<5.0							<5	<5	17.5	15.8	9.3	15
8-Mar-21	NH_3-N (mg/L)	<0.2	<0.2											
9-Mar-21	NH_3-N (mg/L)	<0.2		<0.2		<0.2	<0.2							
10-Mar-21	NH_3-N (mg/L)	<0.2						<0.2						
8-Mar-21	NO_3-N (mg/L)	<5.0	<0.02											
9-Mar-21	NO_3-N (mg/L)	<5.0		<0.02		<0.02	<0.02							
10-Mar-21	NO_3-N (mg/L)	<5.0						<0.02						
8-Mar-21	Faecal coliform (MPN/100 mL)	<1,000	540											
9-Mar-21	Faecal coliform (MPN/100 mL)	<1,000		11		0	0							

		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												
10-Mar-21	Faecal coliform (MPN/100 mL)	<1,000						0	2	11	7	11	17	170
8-Mar-21	Total Coliform (MPN/100 mL)	<5,000	1,600											
9-Mar-21	Total Coliform (MPN/100 mL)	<5,000		49		0	0							
10-Mar-21	Total Coliform (MPN/100 mL)	<5,000						0	17	17	26	22	130	350
8-Mar-21	TKN		<1.5											
9-Mar-21	TKN			<1.5		<1.5	<1.5							
10-Mar-21	TKN							<1.5						
8-Mar-21	TOC (mg/L)		4.83											
9-Mar-21	TOC (mg/L)													
10-Mar-21	TOC (mg/L)								1.68	1.8	1.34	1.33	1.35	1.44
9-Mar-21	Phytoplankton Biomass (g dry wt/m³)			16.6		0.6	1.6							
10-Mar-21	Phytoplankton Biomass (g dry wt/m³)							0.8						
8-Mar-21	Total Phosphorus (mg/L)		<0.01											
9-Mar-21	Total Phosphorus (mg/L)			<0.01		0.02	<0.01							
10-Mar-21	Total Phosphorus (mg/L)							<0.01						
8-Mar-21	Total Dissolved Phosphorus (mg/L)		<0.01											
9-Mar-21	Total Dissolved Phosphorus (mg/L)			<0.01		<0.01	<0.01							
10-Mar-21	Total Dissolved Phosphorus (mg/L)							<0.01						
9-Mar-21	Hydrogen Sulfide (mg/L)			0.05		<0.02	<0.02							
10-Mar-21	Hydrogen Sulfide (mg/L)							<0.05						
9-Mar-21	Turbidity (NTU)-bottom					3.92	5.29							
10-Mar-21	Turbidity (NTU)-bottom							2.8						

		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												
9-Mar-21	TSS (mg/L)-bottom					<5	<5							
10-Mar-21	TSS (mg/L)-bottom							<5						
9-Mar-21	BOD_5 (mg/L)-bottom					<1	<1							
10-Mar-21	BOD_5 (mg/L)-bottom							1.29						
9-Mar-21	Total Coliform (MPN/100 mL)-bottom					0	0							
10-Mar-21	Total Coliform (MPN/100 mL)-bottom							6.8						
9-Mar-21	Faecal coliform (MPN/100 mL)-bottom					0	0							
10-Mar-21	Faecal coliform (MPN/100 mL)-bottom							0						
9-Mar-21	NH_3-N (mg/L)-bottom					<0.2	<0.2							
10-Mar-21	NH_3-N (mg/L)-bottom							<0.2						
9-Mar-21	NO_3-N (mg/L)-bottom					<0.02	<0.02							
10-Mar-21	NO_3-N (mg/L)-bottom							<0.02						
9-Mar-21	TKN-bottom					<1.5	<1.5							
10-Mar-21	TKN-bottom							<1.5						
9-Mar-21	Total Dissolved Phosphorus (mg/L)-bottom					<0.01	0.02							
10-Mar-21	Total Dissolved Phosphorus (mg/L)-bottom							<0.01						
9-Mar-21	Total Phosphorus (mg/L)-bottom					<0.01	0.02							
10-Mar-21	Total Phosphorus (mg/L)-bottom							<0.01						
9-Mar-21	Hydrogen Sulfide (mg/L)-bottom					<0.02	<0.02							
10-Mar-21	Hydrogen Sulfide (mg/L)-bottom							<0.02						

		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												
9-Mar-21	Phytoplankton Biomass (g dry wt/m³)-bottom					1.8	1.4							
10-Mar-21	Phytoplankton Biomass (g dry wt/m³)-bottom							2						

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**				
2-Mar-21	pH	5.0 - 9.0		6.91		
3-Mar-21	pH	5.0 - 9.0			7.5	7.8
8-Mar-21	pH	5.0 - 9.0	7.93			
9-Mar-21	pH	5.0 - 9.0		8.4		
10-Mar-21	pH	5.0 - 9.0			7.48	7.44
16-Mar-21	pH	5.0 - 9.0				
17-Mar-21	pH	5.0 - 9.0			7.03	7.55
22-Mar-21	pH	5.0 - 9.0	6.92			
23-Mar-21	pH	5.0 - 9.0				
24-Mar-21	pH	5.0 - 9.0			7.76	6.77
30-Mar-21	pH	5.0 - 9.0				
31-Mar-21	pH	5.0 - 9.0			6.97	7.33
2-Mar-21	Sat. DO (%)			88		
3-Mar-21	Sat. DO (%)				78.3	73.4
8-Mar-21	Sat. DO (%)		101.2			
9-Mar-21	Sat. DO (%)			89.4		
10-Mar-21	Sat. DO (%)				78.6	78.1
16-Mar-21	Sat. DO (%)					
17-Mar-21	Sat. DO (%)				80.5	85.2
22-Mar-21	Sat. DO (%)		96.1			
23-Mar-21	Sat. DO (%)					
24-Mar-21	Sat. DO (%)				81.3	78.9
30-Mar-21	Sat. DO (%)					
31-Mar-21	Sat. DO (%)				64.6	66.2
2-Mar-21	DO (mg/L)	>6.0		7.57		
3-Mar-21	DO (mg/L)	>6.0			6.32	6.14
8-Mar-21	DO (mg/L)	>6.0	8.47			
9-Mar-21	DO (mg/L)	>6.0		7.55		
10-Mar-21	DO (mg/L)	>6.0			6.16	6.5
16-Mar-21	DO (mg/L)	>6.0				
17-Mar-21	DO (mg/L)	>6.0			6.41	7.01
22-Mar-21	DO (mg/L)	>6.0	8.24			

		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				
23-Mar-21	DO (mg/L)	>6.0				
24-Mar-21	DO (mg/L)	>6.0			6.55	6.14
30-Mar-21	DO (mg/L)	>6.0				
31-Mar-21	DO (mg/L)	>6.0			5.57	5.41
2-Mar-21	Conductivity (µs/cm)			69		
3-Mar-21	Conductivity (µs/cm)				140	49
8-Mar-21	Conductivity (µs/cm)		36			
9-Mar-21	Conductivity (µs/cm)			70		
10-Mar-21	Conductivity (µs/cm)				137	55
16-Mar-21	Conductivity (µs/cm)					
17-Mar-21	Conductivity (µs/cm)				122	44
22-Mar-21	Conductivity (µs/cm)		41			
23-Mar-21	Conductivity (µs/cm)					
24-Mar-21	Conductivity (µs/cm)				95	47
30-Mar-21	Conductivity (µs/cm)					
31-Mar-21	Conductivity (µs/cm)				128	50
2-Mar-21	Temperature (°C)			22.81		
3-Mar-21	Temperature (°C)				26.25	24.62
8-Mar-21	Temperature (°C)		21.8			
9-Mar-21	Temperature (°C)			23.81		
10-Mar-21	Temperature (°C)				27.86	24.2
16-Mar-21	Temperature (°C)					
17-Mar-21	Temperature (°C)				26.98	25.26
22-Mar-21	Temperature (°C)		22.98			
23-Mar-21	Temperature (°C)					
24-Mar-21	Temperature (°C)				24.64	24.2
30-Mar-21	Temperature (°C)					
31-Mar-21	Temperature (°C)				26.84	26.29
2-Mar-21	Turbidity (NTU)			2.53		
3-Mar-21	Turbidity (NTU)				3.22	2.91
8-Mar-21	Turbidity (NTU)		3.46			
9-Mar-21	Turbidity (NTU)			3.05		
10-Mar-21	Turbidity (NTU)				2.64	2.71
16-Mar-21	Turbidity (NTU)					
17-Mar-21	Turbidity (NTU)				3.08	3.06

		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				
22-Mar-21	Turbidity (NTU)		2.55			
23-Mar-21	Turbidity (NTU)					
24-Mar-21	Turbidity (NTU)				9.23	8.19
30-Mar-21	Turbidity (NTU)					
31-Mar-21	Turbidity (NTU)				3.22	3.27
8-Mar-21	TSS (mg/L)		<5			
9-Mar-21	TSS (mg/L)					
10-Mar-21	TSS (mg/L)					
8-Mar-21	BOD_5 (mg/L)	<1.5	<1			
9-Mar-21	BOD_5 (mg/L)	<1.5		<1		
10-Mar-21	BOD_5 (mg/L)	<1.5			<1	<1
8-Mar-21	COD (mg/L)	<5.0	6.7			
9-Mar-21	COD (mg/L)	<5.0		9.8		
10-Mar-21	COD (mg/L)	<5.0			10.2	6.7
8-Mar-21	NH_3-N (mg/L)	<0.2	<0.2			
9-Mar-21	NH_3-N (mg/L)	<0.2		<0.2		
10-Mar-21	NH_3-N (mg/L)	<0.2				
8-Mar-21	NO_3-N (mg/L)	<5.0	<0.02			
9-Mar-21	NO_3-N (mg/L)	<5.0		<0.02		
10-Mar-21	NO_3-N (mg/L)	<5.0				
8-Mar-21	Faecal coliform (MPN/100 mL)	<1,000	170			
9-Mar-21	Faecal coliform (MPN/100 mL)	<1,000		79		
10-Mar-21	Faecal coliform (MPN/100 mL)	<1,000			26	34
8-Mar-21	Total Coliform (MPN/100 mL)	<5,000	540			
9-Mar-21	Total Coliform (MPN/100 mL)	<5,000		920		
10-Mar-21	Total Coliform (MPN/100 mL)	<5,000			40	170
8-Mar-21	TKN (mg/L)		<1.5			
9-Mar-21	TKN (mg/L)			<1.5		
10-Mar-21	TKN (mg/L)					
8-Mar-21	TOC (mg/L)		1.35			
9-Mar-21	TOC (mg/L)			1.19		
10-Mar-21	TOC (mg/L)				2.28	1.64
8-Mar-21	Total Phosphorus (mg/L)		<0.01			
9-Mar-21	Total Phosphorus (mg/L)			<0.01		
10-Mar-21	Total Phosphorus (mg/L)					

		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				
8-Mar-21	Total Dissolved Phosphorus (mg/L)		<0.01			
9-Mar-21	Total Dissolved Phosphorus (mg/L)			<0.01		

ANNEX B: RESULTS OF EFFLUENT ANALYSES

TABLE B-1: RESULTS OF CAMP EFFLUENTS IN MARCH 2021

	Site Name	OSOV1 (Owner's Site Office and Village)		OSOV2 (ESD Camp)		Main Powerhouse	
	Station Code	EF01		EF13		EF19	
	Date	01-Mar-21	15-Mar-21	01-Mar-21	15-Mar-21		15-Mar-21
Parameters (Unit)	**Guideline**						
pH	6.0 - 9.0	6.94	6.95	7.01	7.01		7.16
Sat. DO (%)		44.7	46.9	18.8	58.8		64.4
DO (mg/L)		3.48	3.76	1.42	4.7		4.87
Conductivity (µs/cm)		327	432	342	861	No	981
TDS (mg/L)		163.5	216	171	430.5	discharge	490.5
Temperature (°C)		26.6	26.62	28.3	26.74		29.71
Turbidity (NTU)		2.04	2.56	16.35	11.58		12.32
TSS (mg/L)	<50	<5	<5	32.4	16.0		43.0
BOD_5 (mg/L)	<30	<6	<6	<6	<6		8.52
COD (mg/L)	<125	<25	<25	46	142		124
NH_3-N (mg/L)	<10.0	12	8	15.1	15.4		42.3
Total Nitrogen (mg/L)	<10.0	27	13	17.7	21.3		62.8
Total Phosphorus (mg/L)	<2	1.91	1.83	2.37	1.25		8.69
Oil & Grease (mg/L)	<10.0	<1		3			
Total coliform (MPN/100 mL)	<400	27	17	0	0		0
Faecal Coliform (MPN/100 mL)	<400	14	5	0	0		0
Effluent Discharge Volume (L/mn)		7.5	3	4.6	4		1200
Chlorination Dosing Rate (mL/mn)		n/a	n/a	28.00	28.00		300
Residual Chlorine (mg/L)	<1.0	n/a	n/a	0.23	0.72		1.41