



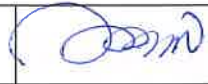


**NAM NGIEP 1**  
POWER COMPANY

## Nam Ngiep 1 Hydropower Project

# Environmental Management Monthly Monitoring Report

January 2023

					
A	23 February 2023	Hendra WINASTU	Khamstone XAYSOMPHOU	Wanidaporn RODE	Final
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## EXECUTIVE SUMMARY

During January 2023, activities related to ISO14001:2015 implementation continued such as a review of the annual ISO14001 Internal Audit results of all 31 areas/work functions and the implementation of the Environmental Management Plan and its achievements. A total of 39 Opportunities for Improvement (OFI) were identified and no Corrective Action Requests (CAR) were raised in this internal audit. The management review was carried out in early January 2023. The first surveillance audit (on site, two-man days) by SGS was scheduled and confirmed to be conducted on 16-17 February 2023.

During this reporting period, no new document was submitted to the Environment Management Office (EMO) for review and approval. EMO did not issue any Site Inspection Report of Observation of Non-Compliance (ONC) or Non-Compliance Reports (NCR) to any Contractor. There are no pending Non-Compliance Reports.

The wastewater treatment system operation and maintenance were regularly monitored in January 2023 including chlorine dosing and bi-weekly inspections of the septic tank and wetland systems. The results of the effluent analyses of the WWTSSs show improvements as a result of many adjustments and corrective actions in 2022.

During January 2023, water quality analyses for COD, TOC, ammonia nitrogen, total nitrogen, total phosphorus, total dissolved phosphorus, oil & grease, chlorophyll-A, and TKN were not carried out due to delays with the contract extension for the laboratory services. In addition, the water quality could not be monitored in Nam Phouan (NPH01) as access to the site was blocked by floating debris.

At R05 (in the Main Reservoir approx. 0.5 km upstream the Main Dam), the average DO concentration was 4.3 mg/L in the upper 34 m varying between 3.4 mg/L and 5.1 mg/L with no oxycline. The anoxic condition (less than 0.5 mg/L) were found at depths from 40 m to bottom (05 and 11 January 2023), from 36 m to bottom (18 January 2023) and from 38 m to bottom (25 January 2023). At the water intake level, DO concentrations varied between 0.20 mg/L and 4.37 mg/L. In the Re-regulation Reservoir, the mean DO concentrations in the water column of the two monitoring stations were 4.2 mg/L and 4.3 mg/L respectively.

The DO measurements downstream the Re-regulation Dam during gate discharge was greater than 6 mg/L in all stations.

NNP1PC continues to carefully compile and assess all monitoring data to determine if any additional water aeration measures may be necessary to improve the DO levels in Nam Ngiep River downstream the Re-regulation Dam. Water quality monitoring will be maintained, and the development of the situation in the reservoir and in the downstream area will be closely followed until a satisfactory situation has been reached. In this regard, it should be noted that since the Commercial Operation Date (COD) in September 2019 no dead fish have been observed in Nam Ngiep downstream the Re-regulation Dam.

In January 2023, NNP1PC-EMO followed up on the handover of the communities' solid waste management and the Houay Soup Landfill operation to the local authorities (Bolikhan district Environment Management Unit or EMU). It is expected that the community solid waste management will be fully handed over to the local authorities within 2023.

A total of 9.04 m<sup>3</sup> of solid waste was disposed of at the NNP1 Project Landfill, a decrease of 2.14 m<sup>3</sup> compared with December 2022. The communities' general waste collection and the Houay Soup Landfill operation is under the hand-over process to be managed by the local authorities (Bolikhan District Environment Management Unit or EMU in Bolikhamxay Province).

The Bolikhamxay Watershed and Reservoir Protection Office (WRPO) conducted forest and reservoir patrolling work during 16-25 January 2023 and 13-22 January 2023 respectively. ADB and the Independent Advisory Panel (IAP) provided confirmation of no objection for the Bolikhamxay AIP2023 on 18 and 20 January 2023 respectively. Bolikhamxay WRPO further revised the budget based on the new GOL financial policy No. 0200/MoF that was issued on 25 January 2023. NNP1 EMO agreed with the revised version on 31 January 2023 and Bolikhamxay WRPO is processing the internal approval by Head of Bolikhamxay WRPO and submission to Forest Protection Fund (FPF) office of Ministry of Agriculture and Forestry (MAF).

The Head of Xaysomboun WRPO informed that the meeting on the role and responsibility for the reservoir fishery co-management could not be organized in January 2023 because he was occupied with other assignment including the meeting on the Financial Management Manual (FMM), the internal PAFO monthly meeting, and the survey to land concession area in Thathom District. The Head of Xaysomboun WRPO also informed that they are compiling the inputs from the team and reviewing the budget for their AIP2023 to be aligned with the new GOL financial policy (No. 0200/MoF). The Xaysomboun WRPO will submit the draft AIP2023 to NNP1 EMO in the second week of February 2023 as soonest.

The Head of Bolikhamxay Biodiversity Offset Management Unit (BOMU) informed that they planned to have meeting with the Head of Bolikhamxay Province Agriculture and Forestry Office (PAFO) and the Vice Governor of Bolikhamxay Province for the approval of the Nam Chouane-Nam Xang (NC-NX) and its Totally Protected Zone (TPZ) boundary in February 2023. The patrolling and snare removal were started on 13 and 15 January 2023 respectively. BOMU together with NNP1 EMO and Biodiversity Service Provider (BSP)-Wildlife Conservation Society (WCS) assessed the Community Development Plan (CDP) activities in Viengthong District, Bolikhamxay Province, during 9-13 January 2023. The Head of Bolikhamxay BOMU informed NNP1 EMO in the last week of January 2023 that they are working on the budget revision of their AIP2023 following the new GOL financial policy (No. 0200/MoF) and expect it to be ready in the second week of February 2023 after the Land Use Plan (LUP) meeting in Viengthong District.

The 2-day follow up workshop on the Financial Management Manual (FMM) with GOL was organized on 19-20 January 2023. NNP1 EMO is revising the unit rates following the new GOL financial policy (No. 0200/MoF). The Forest Protection Fund (FPF) office of the Ministry of Agriculture and Forestry (MAF) will compile all comments from relevant parties, review the improved draft FMM, and proceed with the approval process.

The fish catch monitoring for December 2022 in Nam Ngiep Watershed was dominated by *Oreochromis niloticus* and *Channa striata* and species groups of Hampala, Poropuntius, *Sikukia gudgeri* and *Amblyrhynchichthys truncates*. They are classified as Least Concern (LC) according to the IUCN Red List of Threatened Species, except *Sikukia gudgeri* is classified as Data deficient (DD) and *Oreochromis niloticus* is an exotic species. The recorded catch of threatened species includes two Vulnerable species (VU): *Scaphognathops bandanensis* and *Tor sinensis*.


## 1. ENVIRONMENTAL MANAGEMENT MONITORING

### 1.1 ENVIRONMENTAL MANAGEMENT SYSTEM (EMS)

During January 2023, activities related to ISO14001:2015 implementation continued including a review of the annual ISO14001 Internal Audit results of all 31 areas/work functions and the implementation of the Environmental Management Plan and its achievements. A total of 39 opportunities for Improvement (OFI) were identified and no Corrective Action Requests (CAR) were raised in this internal audit. The management review was carried out in early January 2023. The first surveillance audit (on-site, two-man days) by SGS was scheduled and confirmed to be conducted on 16-17 February 2023. In addition, the internal audit was performed for the new food supply and canteen operator (KGS) in late January 2023, there were no non-compliances raised and one OFI for the development of the SOP for LPG handling.

The confirmed plan for the first surveillance audit is shown in the table below.

**Table 1.1-1: The ISO14001:2015 Surveillance Audit Plan by SGS.**

			
Audit Plan			
Organization:	Nam Ngiep 1 Power Company		
Address:	Owner's Site Office and Village, Hat Gniun Village, Bolikhan District, Bolikhamxay Province, Lao PDR.		
Visit Number:	2 = 2 MD	Actual Visit Date:	16-17 February 2023
Visit Due by Date:		For auditor information only	
Lead Auditor:	A: Bonnara Busra Dinc (TL & TE EM 25)		
Team Member(s):			
Additional Attendees and Roles			
Standard(s):	ISO14001:2015		
Audit Language:	Thai / English		
Audit Scope:	The Generation and Distribution of Electricity from 290 MW Hydropower Project		
Audit Objectives: To determine conformity of the management system, or parts of it with audit criteria and its: <ul style="list-style-type: none"> <li>- ability to ensure applicable statutory, regulatory and contractual requirements are met,</li> <li>- effectiveness to ensure the client can reasonably expect to achieve specified objectives and to identify as applicable areas for potential improvement.</li> </ul>			

### 1.2 COMPLIANCE MANAGEMENT

In January 2023, EMO did not receive any document for review and approval.

During January 2023, the operation and maintenance of the wastewater treatment systems were regularly monitored including chlorine dosing and storage and bi-weekly inspections of the septic tank and wetland systems. The results of the effluent analyses of the WWTSS show improvements as a result of many adjustments and corrective actions in 2022.

EMO did not issue any Site Inspection Report (SIR) or Non-Compliance Report (NCR) to the Contractor during the reporting period.



### 1.2.1 Site Inspection by the Environment Management Unit (EMU)

There was no monthly site visit by the EMU of Bolikhan District, Bolikhamxay Province. The previous bi-annual site visit report of the EMU of Xaysomboun Province is under preparation by the EMU and is expected to be ready by the next reporting period of February 2023.

### 1.2.2 Site Decommissioning and Rehabilitation

In June 2022, the signed memo of land use handover from the District Office of Energy and Mines confirmed their acceptance of the land use handover to GOL and was reported to the higher provincial government levels.

The discussion on the handover of land (with non-exclusive land use rights) is scheduled for the upcoming site visit by the Department of Energy Business (DEB) of the Ministry of Energy and Mines (MEM) on 10 February 2023,

During January 2023, all 31 rehabilitated areas were inspected and no site disturbances were identified. The assessment of the vegetation cover will be resumed in the rainy season of 2023.

## 1.3 WATER QUALITY MONITORING

The analyses of Total Suspended Solids (TSS), Biochemical Oxygen Demand (BOD<sub>5</sub>), Faecal Coliform Bacteria, Total Coliform Bacteria and *E.coli* have been carried out by NNP1PC's environmental laboratory since August 2017.

Due to delays with the extension of the contract for UAE lab services, the water quality analyses for COD, TOC, ammonia nitrogen, total nitrogen, total phosphorus, total dissolved phosphorus, oil & grease, chlorophyll-A, and TKN were not carried out during this reporting period.

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 *Error! Reference source not found.* of this Report. The status of implementation of the corrective actions addressing non-compliances at the camps and key project facilities are summarized in **Table 1.3-1**.

**Table 1.3-1: Status of Corrective Actions for Non-Compliances at WWTSS in January 2023**

Site	Sampling ID	Status	Corrective Actions
OSOV1	EF01	Non-compliance for total coliform and fecal coliform.	1) Completed proper fence installation to prevent cattle from accessing the OSOV1 wetland ponds (31 March 2022).
OSOV2	EF13	Non-compliance for total coliform and fecal coliform (second fortnightly sampling).	2) Completed additional planting of reeds in the OSOV1 wetland ponds (31 March 2022). 3) The second adding of the proper sludge/seeds into the Aeration Tank at



Site	Sampling ID	Status	Corrective Actions
Main Powerhouse	EF19	Non-compliance for total coliform and fecal coliform (second fortnightly sampling).	<p>OSOVS WWTS and the Biofilm Septic Tank at the Main Powerhouse System.</p> <p>4) Closely monitor the residual chlorine content in the effluents of OSOV2 and the Main Powerhouse WWTS. Chlorination dosage adjustment was successful by June 2022.</p> <p>5) Closely monitor the Influent to compare with the effluent for the specific parameters to check the treatment effectiveness (stopped in Q4 of 2022).</p>

### 1.3.2 Ambient Surface Water and Reservoir 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]).

Weekly depth profile monitoring (pH, DO, conductivity and temperature) has been undertaken since 18 September 2018 for stations located in the Re-regulation reservoir and the main reservoir. The locations of the monitoring stations are shown in **Figure 1.3-1**.

The monitoring results for key parameters (DO, TSS and BOD<sub>5</sub>) during January 2023 are presented in **Table 1.3-2**, **Table 1.3-3**, and **Table 1.3-4**. The full set of data for January 2023 is attached in Annex A. In addition, the trends of DO depth profile timeseries measurement graph for R05 is shown in **Figure 1.3-2**, and the results for DO timeseries are presented as line graphs in **Figure 1.3-3** and DO Long Profile graphs **Figure 1.3-4**.

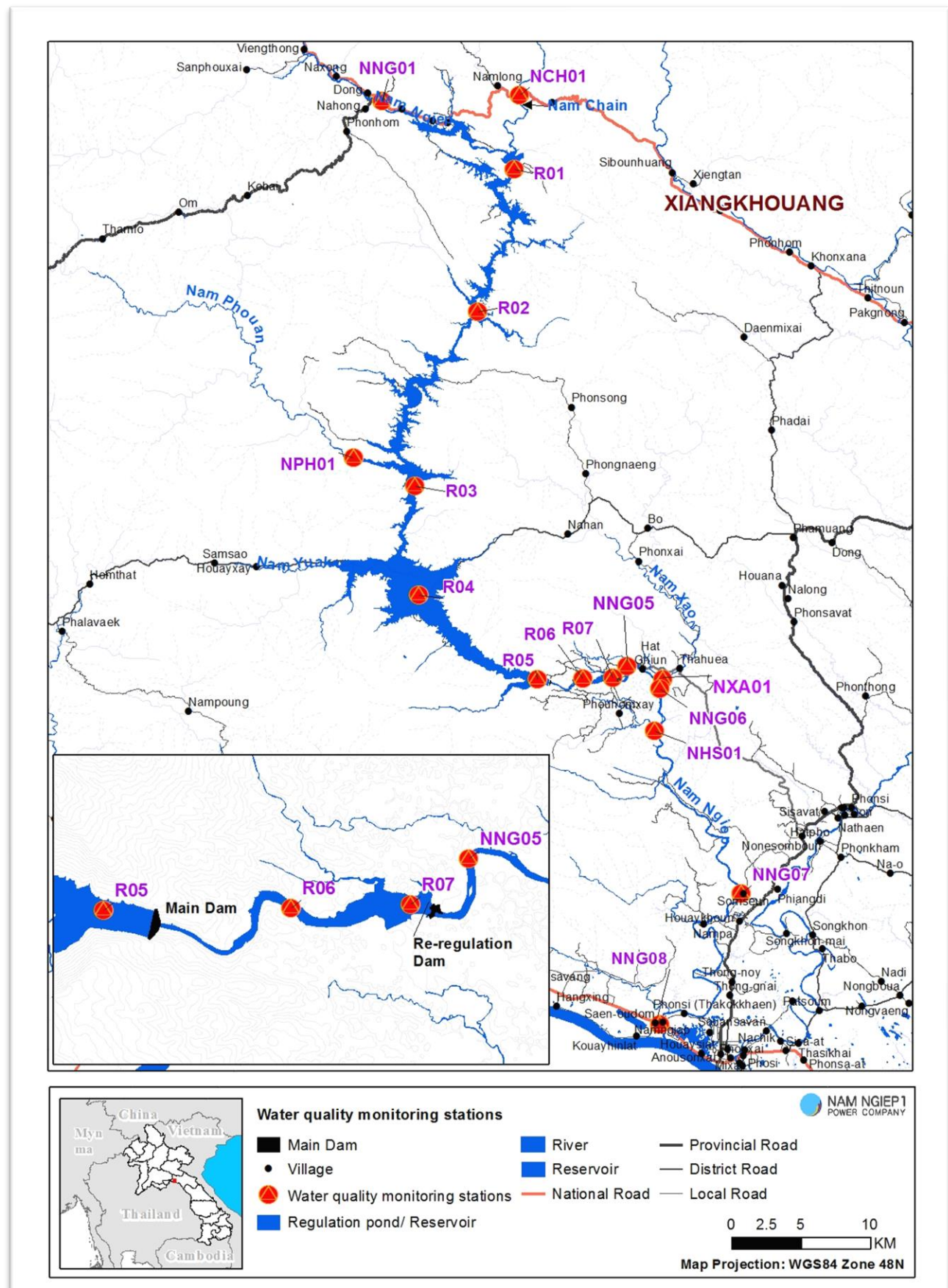
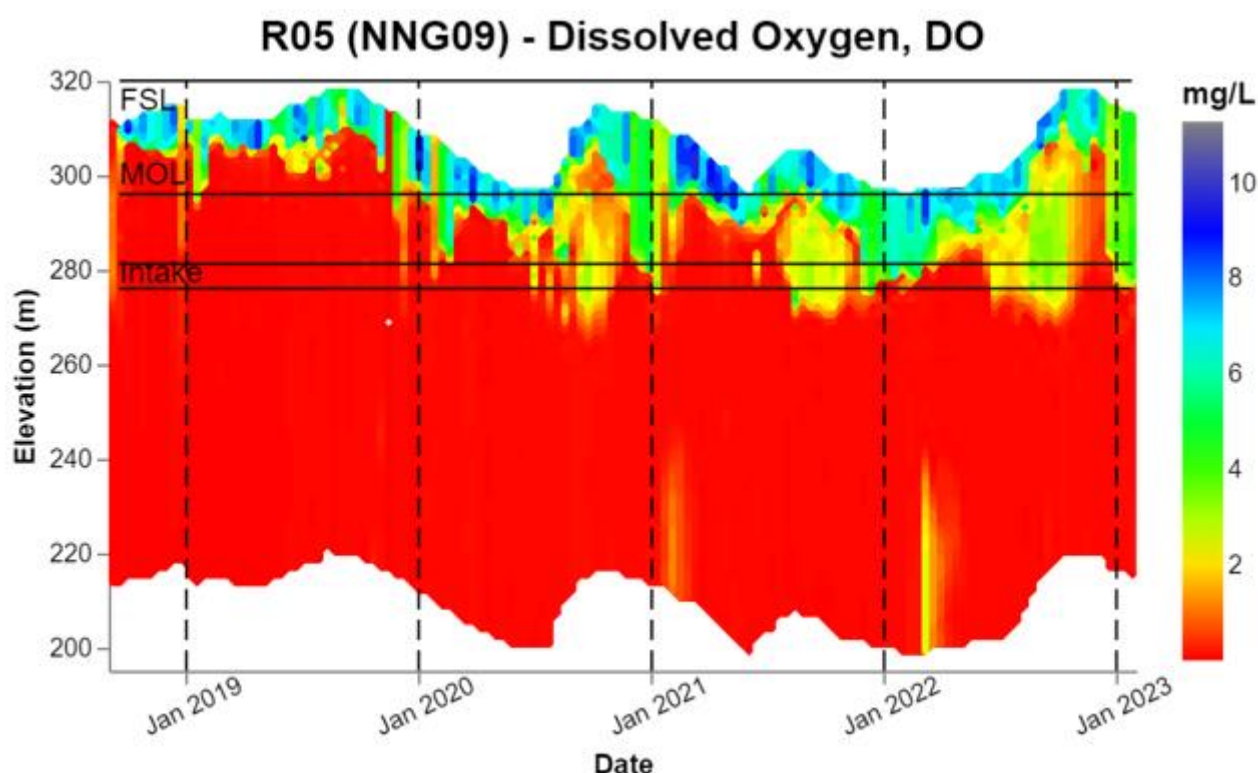


Figure 1.3-1: Surface Water and Re-regulation Reservoir Water Quality Monitoring Stations

## Main Reservoir

During January 2023, the water level in the main reservoir decreased from El. 315.74 m asl to El. 313.93 m asl.

At R05 (in the Main Reservoir approx. 0.5 km upstream the Main Dam), the average DO concentration was 4.3 mg/L in the upper 34 m varying between 3.4 mg/L and 5.1 mg/L. Due to the cool weather throughout the reporting period, the thermocline in R05 deepened to a depth of about 36 m - 40 m resulting in equalization of DO in the epilimnion to concentrations between 3.6 mg/L and 5 mg/L (mean 4.4 mg/L). Below the thermocline, the DO concentrations dropped to below 0.5 mg/L. The oxycline were found at depth of 40 m (on 05 and 11 January 2023), depth of 36 m (on 18 January 2023) and depth of 38 m (on 25 January 2023). Anoxic conditions (less than 0.5 mg/L) were found at depths from 40 m to bottom (05 and 11 January 2023), from 36 m to bottom (18 January 2023) and from 38 m to bottom (25 January 2023). At the water intake level, DO concentrations varied between 0.20 mg/L and 4.37 mg/L.



**Figure 1.3-2: DO Depth Profiles Time Series in R05 (Since September 2018 to December 2022)**

At R04, the average DO concentration was 4.5 mg/L in the upper 34 m varying between 3.4 mg/L and 5.1 mg/L. Due to the cool weather throughout the reporting period, the thermocline in R04 deepened to a depth of about 36 m resulting in equalization of DO in the epilimnion to concentrations between 3.6 mg/L and 5 mg/L (mean 4.4 mg/L). Below the thermocline, the DO concentrations dropped to below 0.5 mg/L. The oxycline were found at depth of 36 m (on 05, 11 and 18 January 2023). From 36 m to bottom, DO concentration varied between 0.09 mg/L and 2.7 mg/L with an average of 0.47 mg/L. The anoxic condition (less than 0.5 mg/L) were found at depths from 38 m to bottom (05 and 11 January 2023) and from 45 m to bottom (18 and 25 January 2023).

At R03, the average DO concentration was 4.6 mg/L in the upper 24 m varying between 3.4 mg/L and 5.7 mg/L. The oxycline was found at depth of 30 m on 05 January 2023. From 26 m to bottom,

DO concentration varied between 0.44 mg/L and 4.6 mg/L with an average of 2.3 mg/L. The anoxic condition (less than 0.5 mg/L) was found at bottom on 24 January 2023.

At R02, the DO levels in the water column varied between 1.3 mg/L and 5.2 mg/L with an average of 3.3 mg/L.

At R01, the DO levels in the water column varied between 4.5 mg/L and 7.9 mg/L with an average of 6.6 mg/L.

As expected, the TSS concentrations in the main reservoir have been consistently low since the start of impounding with a mean of 5 mg/L compared with the high flow season means of about 100 – 250 mg/L and low flow season means of 20 mg/L - 50 mg/L prior to impounding.

The BOD<sub>5</sub> measurements in the epilimnion at R01, R03, R04 and R05 were less than 1.0 mg/L. In the hypolimnion the BOD<sub>5</sub> measurements at R03, R04 and R05 were less than 1.0 mg/L, 11.1 mg/L and 5.3 mg/L respectively.

### **Re-regulation Reservoir**

In January 2023, the turbine discharges from the Main Powerhouse varied between 52 and 229 m<sup>3</sup>/s usually interrupted by night-time periods with no discharge.

The mean DO concentrations in the water column of the two monitoring stations were 4.1 mg/L and 4.3 mg/L in R06 and R07 respectively.

The BOD<sub>5</sub> concentrations in both R06 and R07 were less than 1.0 mg/L.

### **Nam Ngiep Downstream**

During January 2023, the monthly downstream water quality monitoring was carried out during a period with gate discharge from the Re-regulation Dam. The DO concentrations were greater than 6 mg/L in all stations, thus complying with the surface water quality standard.

NNP1PC continues to carefully compile and assess all monitoring data to determine if any additional water aeration measures may be necessary to improve the DO levels in Nam Ngiep River downstream the Re-regulation Dam. Water quality monitoring will be maintained, and the development of the situation in the reservoir and in the downstream area will be closely followed. In this regard, it should be noted that since the Commercial Operation Date (COD) in September 2019 no dead fish have been observed in Nam Ngiep downstream the re-regulation dam.

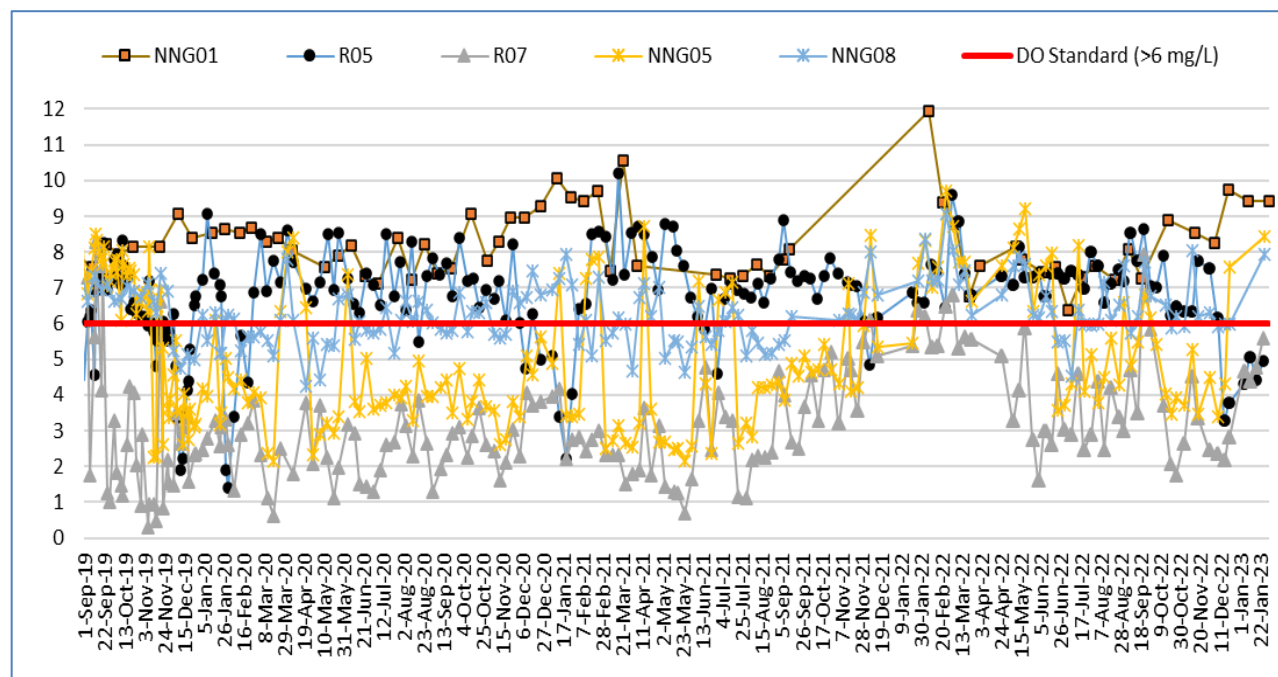
The BOD<sub>5</sub> in the downstream stations were less than 1 mg/L and complied with the national surface water quality standard.

### **Main Tributaries to Nam Ngiep**

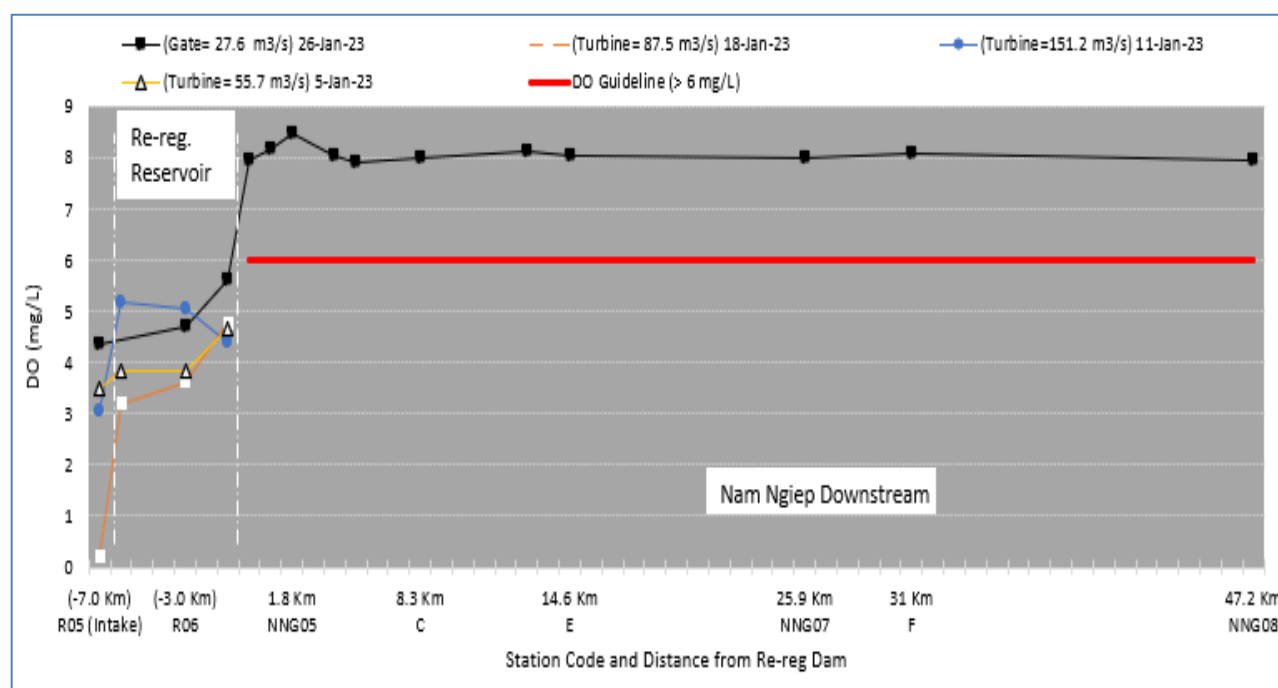
The monitored parameters in the Nam Chiane (NCH01), Nam Xao (NXA01) and Nam Houaysoup (NHS01) complied with the standards.

During January 2023, the water quality could not be monitored in Nam Phouan (NPH01) as access to the site was blocked by floating debris.





**Figure 1.3-3: Concentration of Dissolved Oxygen (mg/L) in the upper 0.2 m since September 2019 to January 2023**



**Figure 1.3-4: Dissolved Oxygen (Mg/L) Long Profile in January 2023 (from Immediately Upper Main Dam to Lower Nam Ngiep River)**

**Table 1.3-2: 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)	NING01	R01	R02	R03	R04	R05	R06	R07	NING05	NING06	NING07	NING08	NCH01	NPH01	NXA01	NHS01
5-Jan-23				4.73	4.66	4.31	3.84	4.66								
9-Jan-23	9.41												9.32			
10-Jan-23		7.05	4.82	4.87												
11-Jan-23					5.12	5.07	5.06	4.4								
17-Jan-23		7.2	3.83	5.7												
18-Jan-23					4.53	4.43	3.62	4.77								
24-Jan-23		7.14	4.29	4.98												
25-Jan-23					4.82	4.96	4.7	5.6								
26-Jan-23									8.45	7.92	7.98	7.95			8.3	8.49
31-Jan-23	9.44												9.34			

**Table 1.3-3: Results of Surface Water Quality Monitoring for Total Suspended Solids (mg/L)**

Total Suspended Solids (mg/L)	NING01	R01	R02	R03	R04	R05	R06	R07	NING05	NING06	NING07	NING08	NCH01	NPH01	NXA01	NHS01
24-Jan-23		<5		<5												
24-Jan-23 Bottom				<5												
25-Jan-23					<5	<5	<5	<5								
25-Jan-23 Bottom					18.4	<5										
26-Jan-23									<5	<5	<5	<5			<5	<5
31-Jan-23	<5												<5			

**Table 1.3-4: Results of Surface Water Quality Monitoring for BOD<sub>5</sub> (mg/L) - Water Quality Standard: < 1.5 mg/L**

BOD <sub>5</sub> (mg/L)	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
24-Jan-23		<1		<1												
24-Jan-23 Bottom				<1												
25-Jan-23					<1	<1	<1	<1								
25-Jan-23 Bottom					11.1	5.3										
26-Jan-23									<1	<1	<1	<1			<1	<1
30-Jan-23	<1												<1			

### 1.3.3 Groundwater Quality Monitoring

During January 2023, community groundwater quality analyses were carried out for only five out of seven wells located in Somseun Village, Nam Pa Village, Thong Noy Village, Pou Village and Phouhomxay Village due to the water pumps in the two wells of Phouhomxay Village were broken. The community groundwater samples were taken from household water taps.

The results indicate that:

- The well in Somsuen Village fully complied with the Standards.
- The well in Thong Noy and Nam Pa Villages did not comply with the Standard for faecal coliform and *E. Coli* bacteria.
- The monitored parameters from two wells in Pou Village complied with the Standards, except pH for GPOU01.

The community groundwater quality monitoring results are presented in **Table 1.3-5**.

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 1.3-5: Groundwater Quality Monitoring Results in Somsuen, Nam Pa, ThongNoy and Pou Villages**

	Site Name	Somseun Village	NamPa Village	ThongNoy Village	Pou Village	
Parameter (Unit)	Station	GSXN01	GNPA01	GTHN01	GPOU01	GPOU02
	Guideline	12-Jan-23	12-Jan-23	12-Jan-23	31-Jan-23	31-Jan-23
pH	6.5 - 9.2	7.0	7.2	7.5	6.48	6.52
Sat. DO (%)		65	84.3	64.1	68.9	68



	Site Name	Somseun Village	NamPa Village	ThongNoy Village	Pou Village	
Parameter (Unit)	Station	GSXN01	GNPA01	GTHN01	GPOU01	GPOU02
	Guideline	12-Jan-23	12-Jan-23	12-Jan-23	31-Jan-23	31-Jan-23
DO (mg/l)		5.19	6.83	5.3	6.42	6.36
Conductivity (µS/cm)		396	423	413	22	227
Temperature (°C)		26.71	25.99	25.13	18.77	22.29
Turbidity (NTU)	<20	1.1	0.31	0.69	1.66	0.73
Faecal coliform (MPN/100ml)	0	0	7.8	70	0	0
<i>E.coli</i> Bacteria (MPN/100ml)	0	0	2	26	0	0

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

The results of the water quality analyses are presented in **Table 1.3-6**.

The concentration of Faecal Coliform and *E.coli* did not comply with the 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). In addition, non-compliance with pH were found in Phouhomxay's water supply system.

As observed in the field during water sampling, livestock are roaming around in 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 in accordance with the Law as mentioned in **1.3.3** as well as recommended to carry out the operation and maintenance improvement.

**Table 1.3-6: 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	12-Jan-23	12-Jan-23	12-Jan-23	12-Jan-23
pH	6.5 - 8.5	6.5	7.2	6.1	6.0
Sat. DO (%)		93.3	85.5	72.8	68.7
DO (mg/L)		7.87	7.24	6.38	5.83
Conductivity (µS/cm)	<1,000	67	111	28	16
Temperature (°C)	<35	23.83	23.84	23.99	23.54
Turbidity (NTU)	<10	4.94	3.66	1.22	0.72
Faecal Coliform (MPN/100 mL)	0	79	49	130	170
<i>E.coli</i> Bacteria (MPN/100 mL)	0	79	22	130	170

### 1.3.5 Landfill Leachate Monitoring

During January 2023, the landfill leachate monitoring was not conducted at NNP1 Project Landfill (Last pond - LL4) and at Houay Soup Solid Waste Landfill (Last pond - LL6) because the ponds had dried out.

## 1.4 DISCHARGE MONITORING

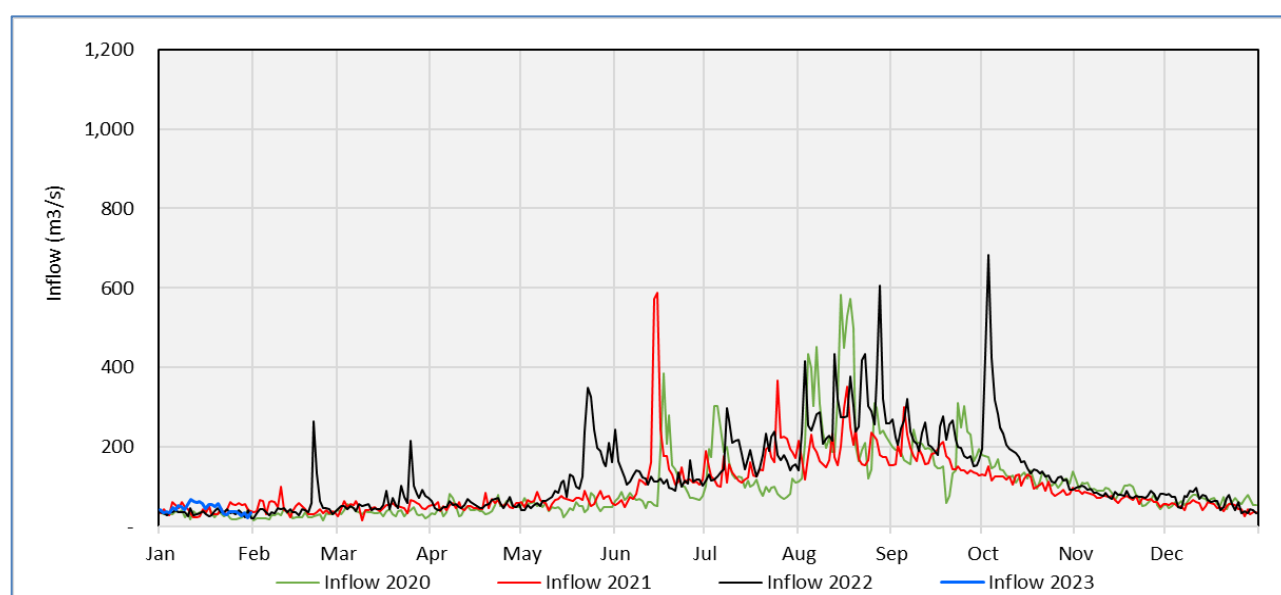
### 1.4.1 Main Reservoir – Water Level, Inflow and Discharge

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 1.4-1** and **Figure 1.4-2** presents the values recorded since January 2020.

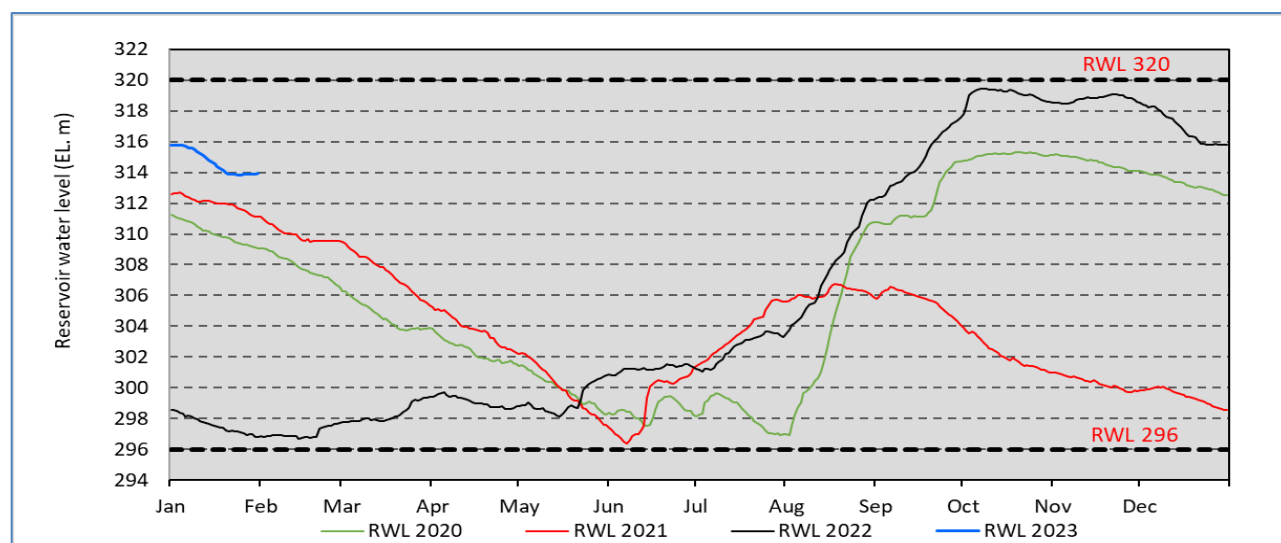
During January 2023, the mean inflow to the main reservoir was 44 m<sup>3</sup>/s. The minimum and maximum inflows were 21 m<sup>3</sup>/s (on 30 January 2023) and 68 m<sup>3</sup>/s (on 11 January 2023) respectively.

In January 2023, the water level in the main reservoir decreased from El. 315.74 m asl to El. 313.93 m asl.

During January 2023, the hourly turbine discharges from the Main Powerhouse varied between 52 m<sup>3</sup>/s and 229 m<sup>3</sup>/s usually interrupted by night-time periods with no discharge.



**Figure 1.4-1: Inflow for the Main Reservoir during January 2020 to January 2023**



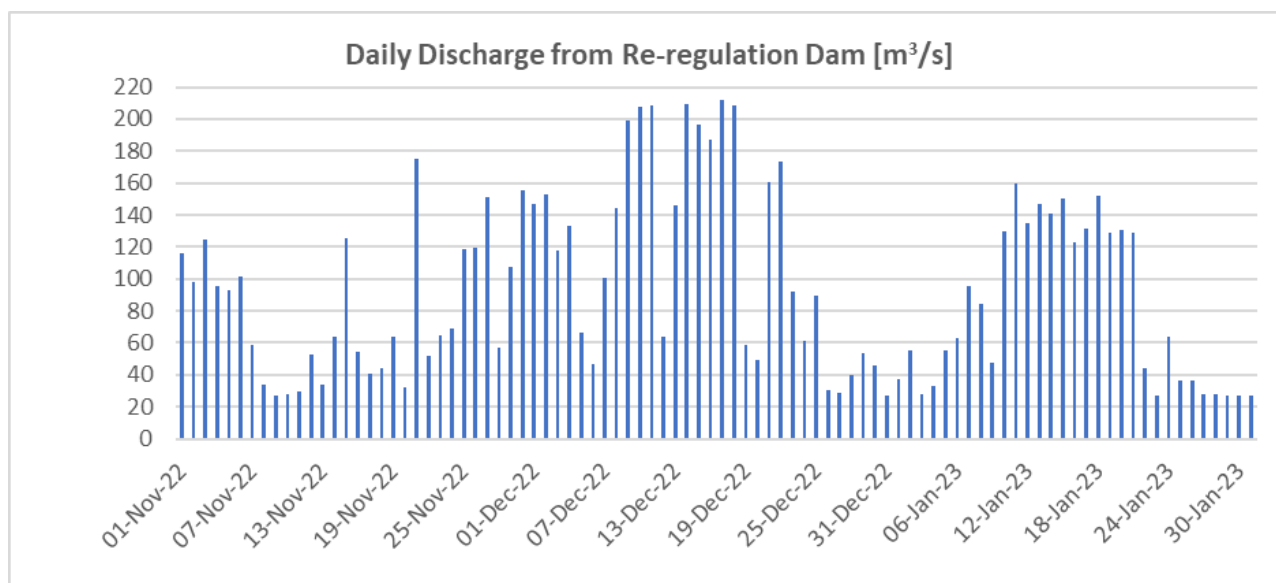
**Figure 1.4-2: Water Level for the Main Reservoir during January 2020 to January 2023**

### 1.4.2 Re-regulation Reservoir – Discharge

The daily discharge monitoring data for the Re-regulation Dam during November 2022 to January 2023 is presented in **Figure 1.4-3**.

During January 2023, the mean daily discharge from the Re-regulation Dam was about 80 m<sup>3</sup>/s, hourly gate discharge varied between 27 m<sup>3</sup>/s and 29 m<sup>3</sup>/s, hourly turbine discharge varied between 48 m<sup>3</sup>/s and 161 m<sup>3</sup>/s, and combination of gate and turbine discharge varied between 38 m<sup>3</sup>/s and 209 m<sup>3</sup>/s. The hourly 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 1.4-3: Discharge Monitoring at the Re-regulation Dam in November 2022 to January 2023**

### 1.4.3 Nam Ngiep Downstream Water Depth Monitoring

In January 2023, EMO carried out a boat mission to monitor the water depth in the Nam Ngiep downstream of the Re-regulation Dam. A total of 19 sites have been identified with potential shallow water depths and during the boat missions, the thalweg water depth was less than 0.5 m at three sites (distance between 1.5 km and 5.6 km from the Re-regulation Dam) during the discharge of about 27 m<sup>3</sup>/s on 26 January 2023, but the team did not have any difficulties with boat navigation.

## 1.5 PROJECT WASTE MANAGEMENT

### 1.5.1 Solid Waste Management

A total of 9.04 m<sup>3</sup> of solid waste was disposed of at the NNP1 Project Landfill, a decrease of 2.14 m<sup>3</sup> compared with December 2022.

The Contractor continued the regular waste collection from the NNP1PC's operation sites and operated the project landfill for three days per week. The work included waste segregation and disposal, waste cover, grass cutting and repairing of the perimeter fences. In January 2023, the solid waste collection contractor submitted the Q3 progress report, but it was found that waste cover was not performed as planned during the Q3 and, therefore, NNP1PC-EMO requested the

contractor to take corrective action for additional soil cover for the disposed solid waste. The action was agreed and will be performed by the contractor in early February 2023.

The total amount of recyclable waste sold and collected this month is summarized in **Table 1.5-1**.

**Table 1.5-1: Amounts of Recyclable Waste Sold and collection in January 2023**

Source and Type of Recycled Waste		Unit	Sold	Cumulative Total by January 2023
1	Plastic bottles	kg	0	222.5
2	Aluminium can	kg	0	0
3	Paper/Cardboard	kg	0	70
4	Glass	kg	0	345
5	Scrap Metal	Kg	0	10
<b>Total</b>		<b>kg</b>	<b>0</b>	<b>647.5</b>

In January 2023, the villagers from Phouhomxay Village collected a total of 286 kg of food waste from the OSOV1 canteen for feeding their animals.

### 1.5.2 Hazardous Materials and Waste Management

The types and amounts of hazardous materials and hazardous waste stored on site in January 2023 are shown in **Table 1.5-2** and **Table 1.5-3** respectively.

**Table 1.5-2: Record of Hazardous Material Inventory in January 2023**

No.	Type of Hazardous Material	Unit	Total in January 2023(A)	Used (B)	Remaining at the end of January 2023 (A – B)
1	Diesel	Litre	7208	4663	2545
2	Gasoline	Litre	2021	355	666
3	Lubricant (Turbine oil)	Litre	5,160	9	5,151
4	Colour Paint	Litre	299	0	299
5	Thinner	Litre	10	0	10
6	Grease Oil	Litre	150	0	150
7	Gear Oil	Litre	426.8	0	426.8
8	Chlorine Liquid	Litre	38	0	38
09	HA Cut AF	Litre	3,925	0	3,925.0
10	HA Cut Cat AF	Litre	372.5	0	372.5

**Table 1.5-3: Record of Hazardous Waste Inventory**

No.	Hazardous Waste Type	Unit	Total in January 2023 (A)	Disposed (B)	Remaining at the end of January 2023 (A - B)
1	Used Oil (Hydraulic + Engine)	Litre	335.3	0	335.3
2	Empty used oil drum/container (drum 200L)	Unit	53	0	53
3	Contaminated soil, sawdust and textile material	m <sup>3</sup>	0.8	0	1
4	Used tyre	Drum	5	0	5
5	Empty used chemical drum/container (drum 20L)	Unit	34	0	34
6	Lead acid batteries	Unit	10	0	10
7	Empty paint and spray cans	Unit	61	0	61
8	Halogen/fluorescent bulbs	kg	322	0	322
9	Empty cartridge (Ink)	Unit	130	0	130
10	Clinic Waste	Kg	5	0	5
11	Expired Chlorine Powder	Kg	65	0	65

## 1.6 COMMUNITY WASTE MANAGEMENT

### 1.6.1 Community Recycling Programme

The process of handing over the community waste bank to the Bolikhan District EMU has continued in January 2023.

There were no recyclable waste trade activities in the community recyclable waste bank in January 2023

### 1.6.2 Community Solid Waste Management

In January 2023, NNP1PC-EMO followed up on the handover of the communities' solid waste management and the Houay Soup Landfill operation to the local authorities (Bolikhan district Environment Management Unit or EMU). This will be followed up during the upcoming EMU quarterly site visit in early 2023.

## **2 WATERSHED AND BIODIVERSITY MANAGEMENT**

### **2.1 WATERSHED MANAGEMENT**

#### **2.1.1 Implementation of Annual Implementation Plan (AIP)**

##### **2.1.1.1 Xaysomboun Watershed and Reservoir Protection Office (WRPO)**

The progress of the actions that were discussed and agreed in the previous monthly meetings as well as the follow up discussions are summarized below:

- Head of Xaysomboun WRPO shared the official agreement of patrol team establishment to NNP1PC EMO and Biodiversity Service Provider (BSP)-Wildlife Conservation Society (WCS) on 4 January 2023. NNP1PC EMO and BSP-WCS team noted that the agreement was already signed on 12 December 2022 and the Head of Xaysomboun WRPO had not provided any clarification for not sharing the agreement after the approval. It was also noted that Xaysomboun WRPO did not incorporate the recommendations that NNP1PC EMO and BSP-WCS have provided to the draft agreement before the approval. Therefore, NNP1PC EMO and BSP-WCS agreed during the internal meeting on 18 January 2023 to assess the team organization and future arrangement including the agreement between Xaysomboun WRPO and the Xaysomboun Provincial Military office as well as the commitment of the assigned staffs. Xaysomboun WRPO agreed to have meeting with NNP1PC EMO and BSP-WCS on 25 January 2023 but none of representatives of Xaysomboun patrolling teams showed up to the meeting.
- NNP1PC EMO, Xaysomboun WRPO, and BSP-WCS had discussion on 24 January 2023 on the patrolling sub-station location re-survey and the delay with construction work since 2021. Xaysomboun WRPO agreed with the technical explanation from BSP-WCS to shift the method of patrolling from the sub-station model to mobile patrolling model. NNP1PC EMO and BSP-WCS recommended to document the technical discussion as reference for the Xaysomboun WRPO to postpone the construction work for TPZ land based sub-stations and only proceed with the construction of reservoir check points. NNP1PC EMO, Xaysomboun WRPO, and BSP-WCS agreed to visit the TPZ reservoir check point locations on 13 February 2023 and the construction should start immediately after this survey.
- The discussion with Xaysomboun provincial management and relevant offices including the mining company about the impact of mining operations in the NNP1 watershed Totally Protected Zone (TPZ) will be organized under the Xaysomboun AIP2022 once the funds have been disbursed.
- The Head of Xaysomboun WRPO informed during the meeting on 24 January 2023 that a meeting on the roles and responsibilities of the NNP1PC reservoir fishery management still could not be organized because he was occupied other assignments including the meeting on the Financial Management Manual (FMM), the internal PAFO monthly meeting, and the survey to land concession area in Thathom District. NNP1PC EMO requested the meeting to be organized in February 2023 without further delay.
- NNP1PC EMO have prepared the action plan to deal with the long delays of Xaysomboun WRPO activities and will have further internal discussions with BSP-WCS in the first week of February 2023. The actions will be communicated with the Head of Xaysomboun PAFO for the support and guidance at the end of February 2023.

### **2.1.1.2 Bolikhamxay Watershed and Reservoir Protection Office (WRPO)**

Bolikhamxay WRPO organized January monthly meeting on 12 January 2023 at Bolikhamxay WRPO office in Bolikhan District. The meeting was attended by 10 members of Bolikhamxay WRPO, two members of BSP-WCS and one member of NNP1PC EMO. The main objective of the meeting was to present the results of forestry and reservoir patrol work in December 2022 and the plan for January 2023 patrolling.

It was noted that the forestry patrol team did not find any threats during the period of 19-26 December 2022. However, NNP1PC EMO and BSP-WCS noted that the patrolling was not conducted according to the plan that was discussed during monthly meeting in December 2022. This includes no proper recording or observation around the concerned area and the tracking was done only along the road. NNP1PC EMO and BSP-WCS strongly recommended the patrolling in January 2023 should only focus within the NNP1 watershed area and BSP-WCS team will join the patrolling.

Bolikhamxay WRPO also shared the reservoir patrol report of December 2022 and noted the finding of illegal logs with a total volume of 17 m<sup>3</sup> at Phou Houay Sue. The reservoir patrol team have informed the Head of Bolikhamxay WRPO for further coordination with Bolikhamxay Provincial Office of Forest Inspection (POFI) to process the case according to the law.

The forest and reservoir patrol were commenced during 16-25 January 2023 and 13-22 January 2023 respectively. Bolikhamxay WRPO informed NNP1PC EMO at the end of January 2023 that they are preparing the report to be discussed during next monthly meeting.

### **2.1.1.3 NNP1PC EMO**

Thathom DAFO shared the information on Kai Noy Rice production under the agriculture extension program from the three households at Nahong and Phonhom villages on 20 January 2023. It was noted that the organic farming demo plot with the total area of 1,600 m<sup>2</sup> produced more Kao Noi rice as compared with the conventional farming demo plot. Farmers requested the GOL and NNP1 staff to continue assisting and monitoring their activity so that they could do better recording and make improvement as necessary.

NNP1 EMO distributed the form for the farmers in PhouNgou and Houayxai villages at Hom District on the investment cost of the cattle program in early January 2023. NNP1 EMO checked with the farmers at the end of January 2023 and noted that they would like to have more guidance. NNP1 EMO will follow up and have discussion with the farmers in February 2023.

## **2.1.2 Preparation of Annual Implementation Plan (AIP) 2022**

### **2.1.2.1 Xaysomboun WRPO**

NNP1PC EMO received the official fund disbursement request from Forest Protection Fund (FPF) office of Ministry of Agriculture and Forestry (MAF) on 20 January 2023. NNP1PC will complete the fund disbursement to FPF in the first week of February 2023.

### **2.1.2.2 Bolikhamxay WRPO**

Bolikhamxay WRPO informed that their AIP2022 fund for Q42022 was transferred by DOF-MAF on 2 November 2022.



### 2.1.3 Preparation of Annual Implementation Plan (AIP) 2023

#### 2.1.3.1 Xaysomboun WRPO

The Head of Xaysomboun WRPO informed NNP1 EMO on 27 January 2023 that he is compiling the inputs from his team and reviewing the budget for their AIP2023 to be aligned with the new GOL financial policy (No. 0200/MoF). The WRPO will submit the draft AIP2023 to NNP1 EMO in the second week of February 2023.

#### 2.1.3.2 Bolikhamxay WRPO

ADB and Independent Advisory Panel (IAP) provided confirmation of no objection for the Bolikhamxay AIP2023 on 18 and 20 January 2023 respectively. Bolikhamxay WRPO further revised the budget based on the new GOL financial policy No. 0200/MoF that was issued on 25 January 2023. NNP1 EMO agreed with the revised version on 31 January 2023 and Bolikhamxay WRPO is processing with the internal approval and submission to the Forest Protection Fund (FPF) office of the Ministry of Agriculture and Forestry (MAF).

## 2.2 BIODIVERSITY OFFSET MANAGEMENT

### 2.2.1 Implementation of BOMP Annual Implementation Plan (AIP)

The progress on the implementation of key activities by Component in January 2023 are described below:

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

The Head of Bolikhamxay Biodiversity Offset Management Unit (BOMU) informed that they plan to have a meeting with the Head of Bolikhamxay Province Agriculture and Forestry Office (PAFO) and the Vice Governor of Bolikhamxay Province for the approval of the Nam Chouane-Nam Xang (NC-NX) and its Totally Protected Zone (TPZ) boundary in February 2023.

#### b. Component 2 – Law Enforcement

The January 2023 patrolling is being implemented from 13 January to 1 February 2023 focussing on TPZ highest priority area including downstream of Nam Sone, Nam Chang, Nam San, and Nam Xi as well as TPZ higher priority area including Nam Houng, Houay Hok, Houay Kengkouang, and Houay Kasae. The results of the January 2023 patrolling will be reported in February 2023. The BOMU staff and one of patrolling teams also installed the signage (size 60 x 80 cm) at the northwest of NC-NX boundary in the third week of January 2023 to increase the awareness of local community about the NC-NX boundary, TPZ, and NC-NX regulation.

The SMART refresher and SOPs training for the patrol and snare removal team was further postponed to the second week of February 2023 because the BOMU key personnel were engaged in the field visit to confirm the Community Development Plan (CDP) activity in Viengthong District and the 2-day follow up FMM workshop in January 2023.

The results of patrolling activity in December 2022 are as follows:

**Table 2.2-1: Results of patrolling activity in December 2022**

Team	Patrolling Area/distance	Observations/Actions Taken
1	TPZ highest priority area including Houay Xay Gnai, Houay Pong, Nam Xi	The team observed a newly improved road section along the old road access at the northwest edge of the TPZ highest priority area.

Team	Patrolling Area/distance	Observations/Actions Taken
	and the southwest mountain ridges of Nam Xi  (16 days covering a distance of 122 km on forest patrolling)	The road section was improved by a tractor for NTFP collection purpose, and the tractor has left at the site before the arrival of the team. With regards to the threat from this NTFP collection, it was agreed by BOMU, BSP and NNP1-EMO to keep the team continue the patrolling and safeguarding at the site.
2	TPZ highest priority area including Nam Chouan, western mountain ridges of Nam Chouan, south of Nam Sone and northern mountain ridge of Nam San  (17 days covering a distance of 72 km on forest patrolling)	The team did not observe any threats during the patrolling.
3	TPZ high priority area including Nam Ma, Nam Pang, Nam Mong and Nam Kapong  (16 days covering a distance of 69 km on forest patrolling)	The team found and destroyed a fishing camp including 2 unusable fishing nets and a fishing tool at Nam Ma, 4 hunting camps at Nam Pang, a hunting camp at Nam Mong and 2 hunting camps at Nam Kapong.
4	TPZ highest priority area including Nam San, the eastern mountain ridges of Nam San and Houay Hree  (16 days covering a distance of 63 km on forest patrolling)	The team did not observe any threats during the patrolling.

**Legend**

- ▲ Village
- ▣ Sub-station
- Road
- River
- Stream
- ▭ District boundary
- ▭ NC-NX Biodiversity Offset Site
- ▭ NC-NX TPZ
- ▭ Highest Priority Area
- ▭ High Priority Area

**Legend**

- ◆ Camp
- ◆ Infrastructure & Roads
- Track for patrolling

**Vietnam**

**Vienghong district**

**Xaychamphone district**

**B. Vangphiang**

**B. Na Ghang**

**B. Natan**

**B. Phonmeuang**

**B. Muangcham**

**B. Sopkhon**

**Scale:** 1:160,000  
5 10 km

**CRS: WGS 1984 UTM ZONE 48N**  
Unit: Meters

**Inset Map:** Vietnam, Bolikhamxay Province, Thailand

	
<p>Road improvement close to Nam Xi in TPZ highest area observed by team 1</p>	<p>Old hunting camp found by Team 3 at Nam Kapong</p>



	
Fishing camp found by Team 3 at Nam Ma	Unusable fishing net found by Team 3 at Nam Ma

### c. Component 3 – Conservation Outreach

The outreach activities that will include a training for the District Team and outreach campaign for the target audiences will be organized in February 2023.

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

The field visit to confirm Community Development Plan (CDP) activities at three villages in Viengthong District was conducted during 9-13 January 2023 with the participation from NNP1 EMO and BSP-WCS. NNP1 EMO and BSP-WCS organized an online discussion on 17 January 2023 to wrap up the assessment including the recommended activities to be implemented under the NC-NX AIP2023. BSP-WCS shared the summary results to NC-NX BOMU on 19 January 2023. The Head of NC-NX BOMU informed NNP1 EMO at the end of January 2023 that he is still reviewing the assessment results and will also elaborate it into the AIP2023.

The January 2023 snare removal was conducted during 15-29 January 2023 with the target area at the upstream of Nam Sone and mountain ridges. The results are being recorded into SMART database.

### e. Component 5 – coordination and collaboration

The Head of NC-NX BOMU informed NNP1 EMO at the end of January 2023 that Bolikhamxay PAFO is still working with the Memorandum of Understanding (MOU) extension between Pu Mat National Park and Bolikhamxay PAFO and will share the Minutes of Meeting (MOM) of Pu Mat National Park team visit to NNP1 EMO after it is signed.

#### 2.2.2 Preparation of Annual Implementation Plan (AIP) 2022

The funds under the AIP2022 for the remaining months of 2022 were transferred by DOF-MAF to Bolikhamxay BOMU on 11 November 2022.

#### 2.2.3 Preparation of Annual Implementation Plan (AIP) 2023

The Head of Bolikhamxay BOMU informed NNP1 EMO in the last week of January 2023 that they are working on the budget revision of their AIP2023 following the new GOL financial policy (No. 0200/MoF) and expect it to be ready in the second week of February 2023 after the Land Use Plan (LUP) meeting in Viengthong District.

The 2-day follow up workshop on the Financial Management Manual (FMM) with GOL was organized on 19-20 January 2023. NNP1 EMO is revising the unit rates following the new GOL financial policy (No. 0200/MoF). The Forest Protection Fund (FPF) office of Ministry of Agriculture and Forestry (MAF) will compile all the comments from relevant parties, reviewed the improved draft FMM, and proceed with the approval process.

## 2.3 FISHERY MONITORING

The fishery monitoring is based on the 7-day reported catch from the Daily Catch Logbook (DCL) survey of the month by covering the upstream, upper reservoir, lower reservoir, downstream and Mekong areas.

The fish species dominating the fish catch by weight in December 2022 as listed in *except Sikukia gudgeri* is classified as Data deficient (DD) and *Oreochromis niloticus* is an exotic species.

**Table 2.3-1.** All species are classified as Least Concern (LC) according to the IUCN Red List of Threatened Species<sup>1</sup> except *Sikukia gudgeri* is classified as Data deficient (DD) and *Oreochromis niloticus* is an exotic species.

**Table 2.3-1: Fish Species dominating the Fish Catch in December 2022**

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
<i>Hampala dispar</i> , <i>Hampala macrolepidota</i>	ປາສຸດ	134.7	LC
<i>Poropuntius normani</i> , <i>Poropuntius laoensis</i> , <i>Poropuntius carinatus</i>	ປາຈາດ	125.1	LC
<i>Oreochromis niloticus</i>	ປານິນ	88	LC
<i>Channa striata</i>	ປາຄໍ້	74.9	LC
<i>Sikukia gudgeri</i> , <i>Amblyrhynchichthys truncatus</i>	ປາຂາວຊາຍ	78.2	DD, LC

The recorded catch of Threatened species (IUCN Red List classification) in December 2022 are presented in **Table 2.3-2**. The list includes two species that are classified as Vulnerable species (VU).

**Table 2.3-2: Threatened Species of December 2022 Fish Catch**

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
<i>Scaphognathops bandanensis</i>	ປາວຽນໄຟ/ປາປຽນ	4	VU
<i>Tor sinensis</i>	ປາແດງ	8	VU

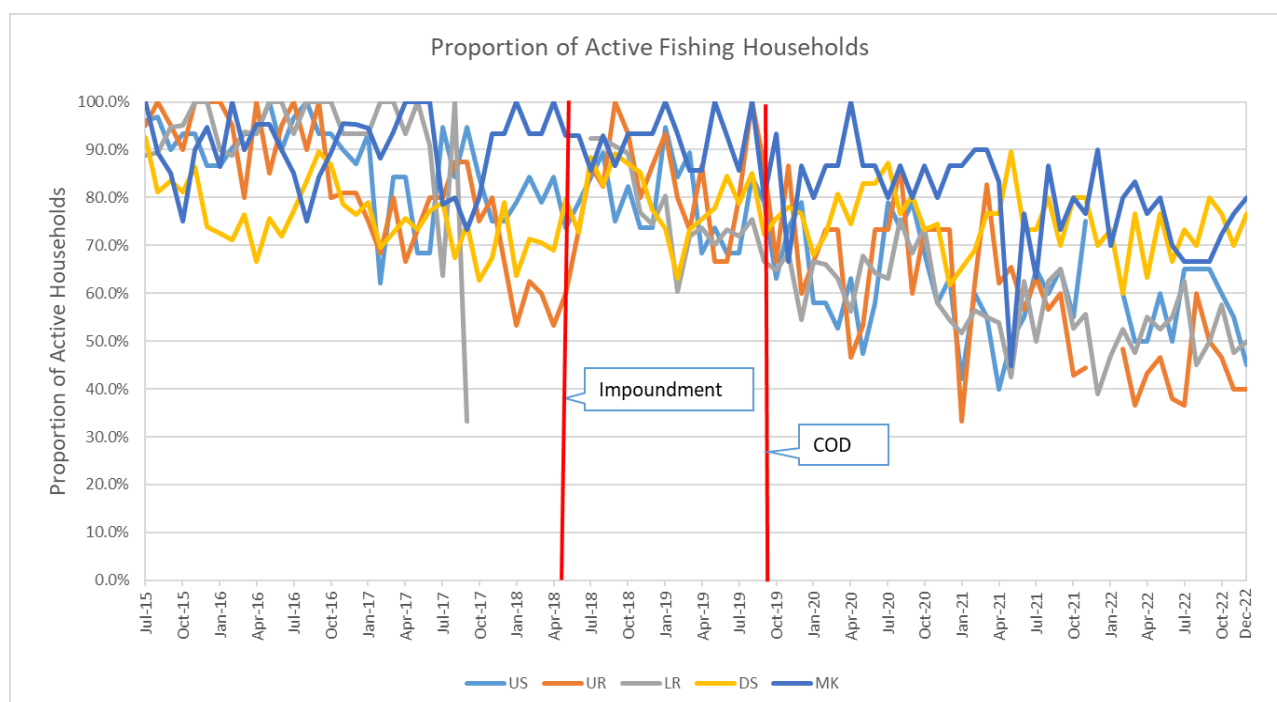
<sup>1</sup> The IUCN Red List of Threatened Species is the world's most comprehensive inventory and classification of threatened species. The Red List classifies species into nine groups: Extinct (EX), Extinct in the wild (EW), Critically endangered (CR), Endangered (EN), Vulnerable (VU), Near threatened (NT), Least concern (LC), Data deficient (DD), and Not Evaluated (NE). The term "Threatened" includes Critically Endangered, Endangered, and Vulnerable.

Species abundance and occurrence is based on the 7-day reported catch from the Daily Catch Logbook (DCL) survey in December 2022. The catch is divided in three areas including above the main dam, below the main dam and Mekong area. Main biodiversity indicators in December 2022 for above dam, below dam and Mekong area are presented in **Table 2.3-3**.

**Table 2.3-3: Main Biodiversity Indicators for December 2022**

Biodiversity Indicators	Mekong	Below dam	Above dam
Total number of species and groups recorded	21	36	34
Single species	19	21	21
Species groups	2	15	13
Top 15 species (% total catch weight)	95.21%	83.14%	93.47%
Proportion for species groups	12.91%	64.75%	48.48%
Diversity index (Shannon)	2.5188	2.8411	2.6315

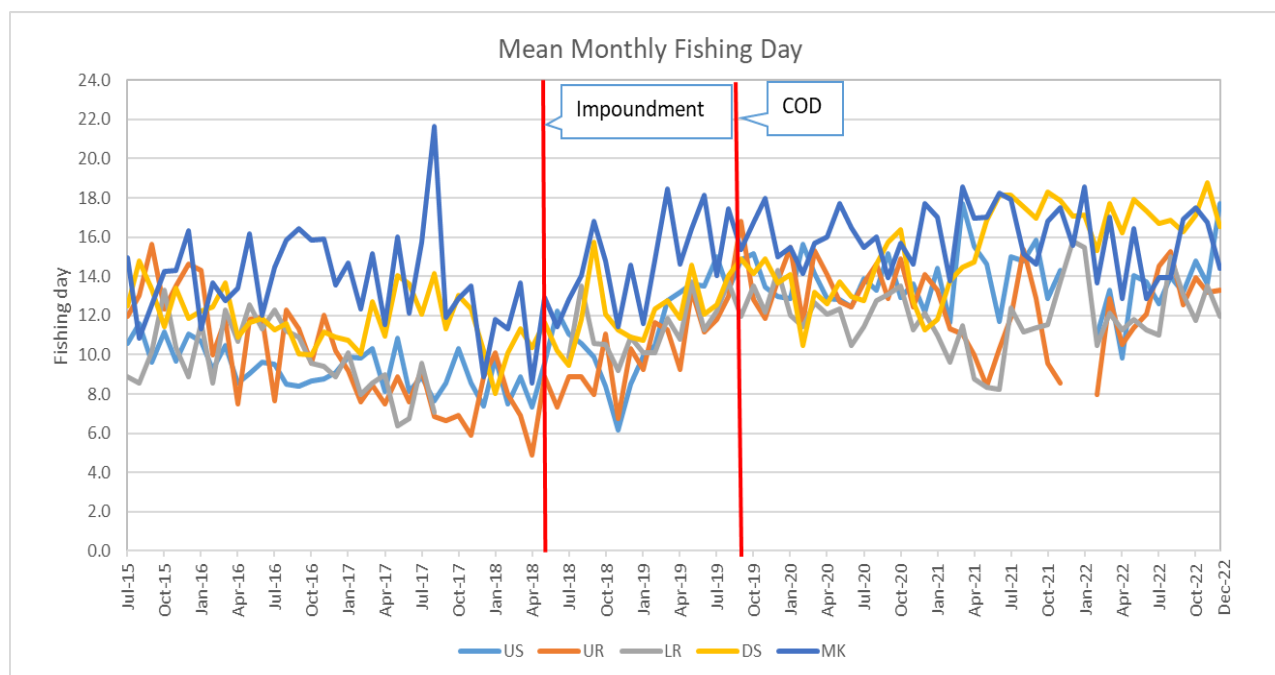
**Figure 2.3-1** shows the proportion of total number of households actively fishing by fishing zone including upstream (US), upper reservoir (UR), lower reservoir (LR), downstream (DS) and Mekong (MK). It ranges between 40% and 80% of active fishing households for all fishing zones in December 2022.



**Figure 2.3-1: Proportion of total number of households actively fishing by fishing zone from July 2015 to December 2022**

**Note:** Proportion of Active Fishing Households = (Active Fishing Households/Total Interviewed Households) x 100%.

**Figure 2.3-2** shows the average (mean) of monthly household fishing days from July 2015 to December 2022 for the upstream (US), upper reservoir (UR), lower reservoir (LR), downstream (DS) and Mekong (MK) area.



**Figure 2.3-2: Mean of monthly fishing day from July 2015 to December 2022**

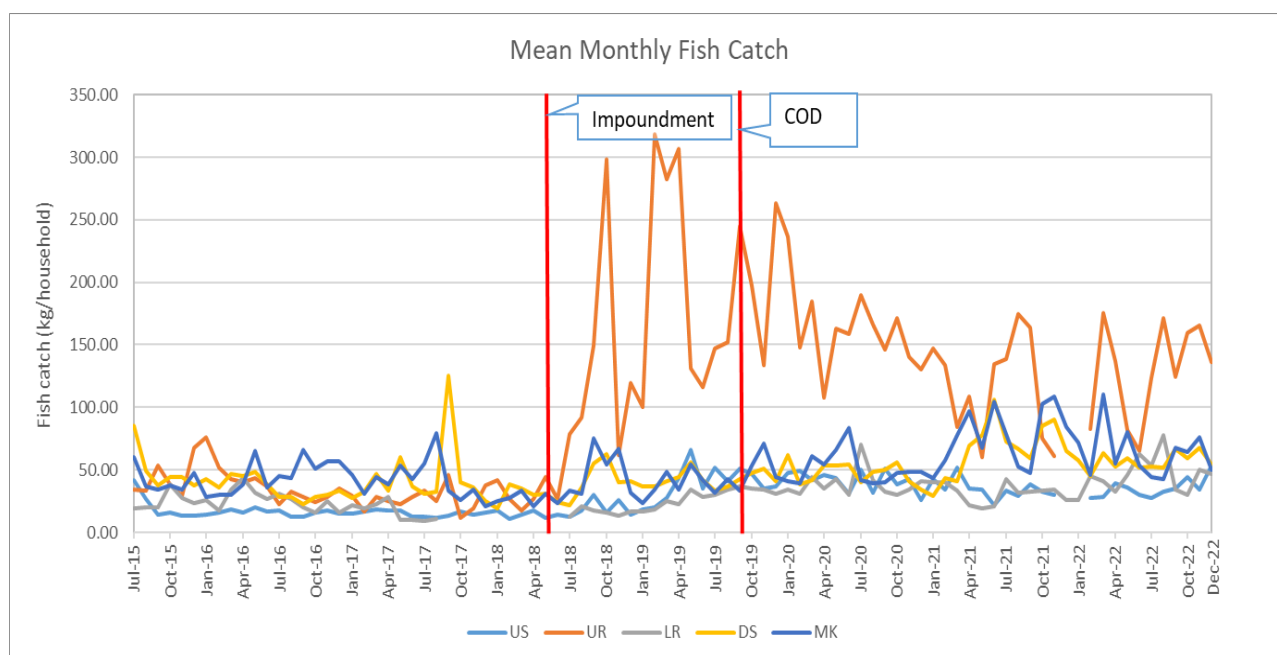
The mean monthly number of fishing days for the month of December from 2015 to 2022 for the upstream, upper reservoir, lower reservoir, downstream and Mekong area are displayed in **Table 2.3-4**.

**Table 2.3-4: Mean reported number of fishing days by fishing zone for the month of December from 2015 to 2022**

Fishing Zone	December 2015 (day)	December 2016 (day)	December 2017 (day)	December 2018 (day)	December 2019 (day)	December 2020 (day)	December 2021 (day)	December 2022 (day)
Upstream	11.07	9.08	7.38	8.49	12.99	12.18	NA	17.71
Upper reservoir	14.65	10.22	8.86	10.33	13.78	14.09	NA	13.29
Lower reservoir	8.86	8.86	NA	10.90	14.29	12.14	15.82	11.96
Downstream	11.88	10.90	10.20	10.91	13.65	11.30	17.08	16.56
Mekong	16.33	13.56	8.86	14.55	14.99	17.71	15.58	14.39

The mean monthly household fish catch from July 2015 to December 2022 for the upstream (US), upper reservoir (UR), lower reservoir (LR), downstream (DS) and Mekong (MK) area are presented in **Figure 2.3-3**.





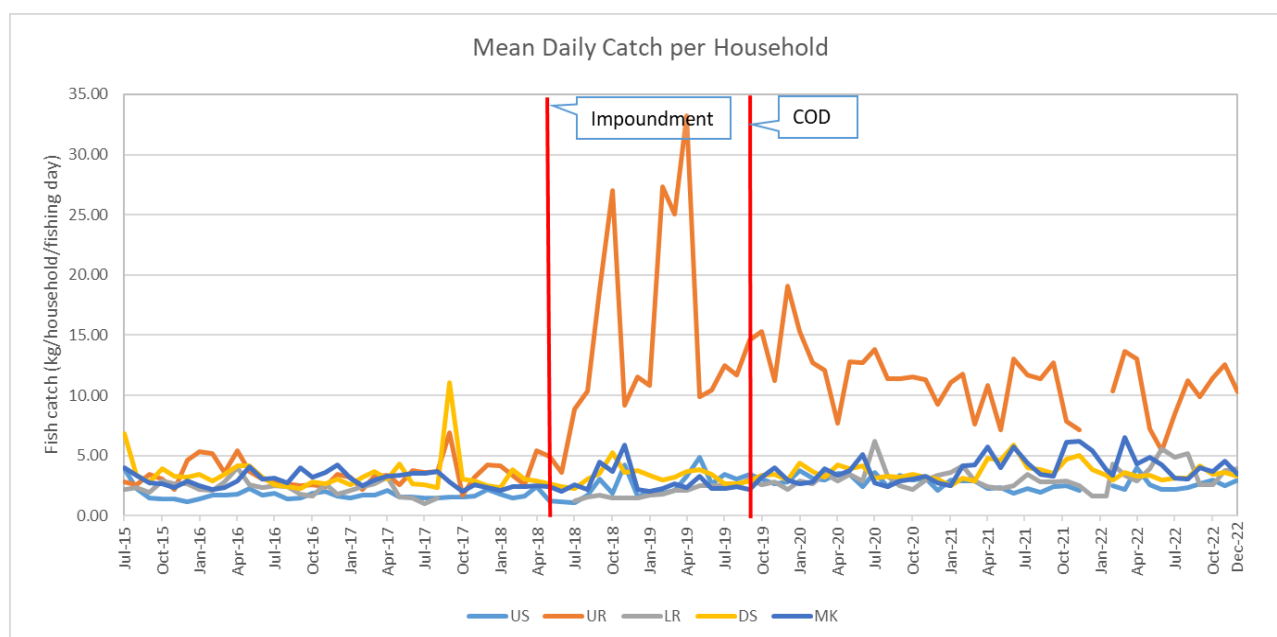
**Figure 2.3-3: Mean Monthly Household Fish Catch from July 2015 to December 2022**

The mean household fish catch for the month of December from 2015 to 2022 in the upstream, upper reservoir, lower reservoir, downstream and Mekong area are displayed in **Table 2.3-5**.

**Table 2.3-5: Mean Monthly Household Fish Catch for the month of December from 2015 to 2022**

Fishing Zone	December 2015 (kg)	December 2016 (kg)	December 2017 (kg)	December 2018 (kg)	December 2019 (kg)	December 2020 (kg)	December 2021 (kg)	December 2022 (kg)
Upstream	12.95	15.15	15.94	13.99	36.82	25.98	NA	53.04
Upper reservoir	67.93	35.12	37.29	119.47	263.01	130.08	NA	136.44
Lower reservoir	23.47	15.68	NA	16.44	30.93	40.79	25.69	47.19
Downstream	37.80	33.23	25.36	40.89	41.03	34.42	65.10	54.12
Mekong	47.61	56.93	20.47	31.54	44.22	48.07	84.26	50.04

The mean daily fish catch per household from July 2015 to December 2022 are displayed in **Figure 2.3-4** and the mean fish catch per household per fishing day for the month of December from 2015 to 2022 are shown in **Table 2.3-6**.



**Figure 2.3-4: Mean Daily Fish Catch per Household from July 2015 to December 2022**

**Table 2.3-6: Mean Daily Fish Catch per Household for the month of December from 2015 to 2022**

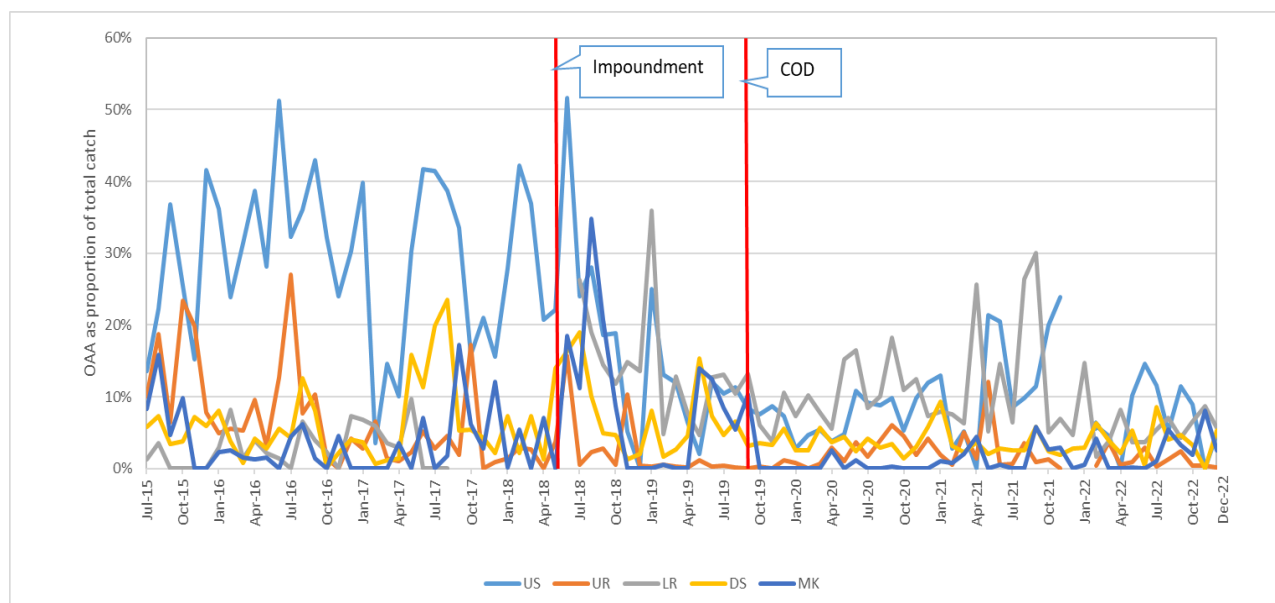
Fishing Zone	December 2015 (kg)	December 2016 (kg)	December 2017 (kg)	December 2018 (kg)	December 2019 (kg)	December 2020 (kg)	December 2021 (kg)	December 2022 (kg)
Upstream	1.17	1.67	2.16	1.65	2.83	2.13	NA	2.99
Upper reservoir	4.64	3.44	4.21	11.56	19.09	9.23	NA	10.27
Lower reservoir	2.65	1.77	NA	1.51	2.17	3.36	1.62	3.95
Downstream	3.18	3.05	2.48	3.75	3.00	3.05	3.81	3.27
Mekong	2.92	4.20	2.31	2.17	2.95	2.71	5.41	3.48

The survey results in December 2022 indicate that Nam Ngiep is the main fishing habitat for the upstream and downstream zone, while the main fishing habitat for the upper reservoir, lower reservoir and Mekong zones are reservoir, tributaries and streams and Mekong respectively. The proportion of fishing habitats in December 2022 are displayed in **Table 2.3-7**.

**Table 2.3-7: Proportion of the catch reported by main habitats (%) in December 2022**

Habitats	US	UR	LR	DS	MK
Mekong	0.0%	0.0%	0.0%	13.3%	87.2%
Nam Ngiep	73.7%	4.9%	0.0%	51.4%	0.0%
Nam Xan	0.0%	0.0%	0.0%	0.0%	0.0%
Reservoir	0.0%	94.0%	19.2%	0.0%	0.0%
Tributaries and streams	26.3%	1.1%	76.7%	32.4%	0.0%
Wetlands	0.0%	0.0%	4.1%	2.8%	12.8%
Others	0.0%	0.0%	0.0%	0.0%	0.0%

Total proportion of other aquatic animals (OAA) in the total reported catch of fish and OAA for the same 7-day period from July 2015 to December 2022 are presented in **Figure 2.3-5** and the proportion of OAA catch for the month of December from 2015 to 2022 are shown in **Table 2.3-8**.



**Figure 2.3-5: Proportion of OAA to the total reported number of fish and OAA for a 7-day period by fishing zone from July 2015 to December 2022**

**Table 2.3-8: Proportion of OAA to the total reported number of fish and OAA for the month of December from 2015 to 2022**

Fishing Zone	December 2015	December 2016	December 2017	December 2018	December 2019	December 2020	December 2021	December 2022
Upstream	41.56%	30.35%	15.63%	0.00%	7.36%	12.00%	NA	4.85%
Upper reservoir	7.86%	4.18%	0.94%	0.49%	1.18%	4.18%	NA	0.19%
Lower reservoir	0.00%	7.33%	NA	13.61%	10.57%	7.34%	4.69%	5.75%
Downstream	5.94%	4.07%	2.23%	2.05%	5.52%	5.81%	2.77%	5.39%
Mekong	0.00%	0.00%	12.13%	0.00%	0.00%	0.00%	0.00%	2.52%

### 3 EXTERNAL MISSIONS AND VISITS

There was no external mission and visit during the month of reporting.

# ANNEXES

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

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						Within / Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG 05	NNG 06	NNG 07	NNG 08	NCH 01	NPH 01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
5-Jan-23	pH	5.0 - 9.0				6.5	6.62	6.7	6.81	6.88								
9-Jan-23	pH	5.0 - 9.0	6.91											7.02				
10-Jan-23	pH	5.0 - 9.0		6.94	6.65	6.49												
11-Jan-23	pH	5.0 - 9.0					6.72	6.84	6.91	6.96								
17-Jan-23	pH	5.0 - 9.0		6.5	6.54	6.55												
18-Jan-23	pH	5.0 - 9.0					6.45	6.53	6.81	6.93								
24-Jan-23	pH	5.0 - 9.0		6.92	6.7	6.65												
25-Jan-23	pH	5.0 - 9.0					6.81	6.76	6.56	6.5								
26-Jan-23	pH	5.0 - 9.0									6.91	6.97	6.79	6.62		7.1	7.05	
31-Jan-23	pH	5.0 - 9.0	6.76											7.05				
5-Jan-23	Sat. DO (%)					56.9	55.9	52.6	45.9	57								
9-Jan-23	Sat. DO (%)		103.8											99.4				
10-Jan-23	Sat. DO (%)			84.8	58.4	58.1												
11-Jan-23	Sat. DO (%)						61.1	60.7	60	51.9								
17-Jan-23	Sat. DO (%)			86.3	45.8	67.9												
18-Jan-23	Sat. DO (%)						53.7	53.3	43.4	57.6								
24-Jan-23	Sat. DO (%)			85.3	52.3	59.4												
25-Jan-23	Sat. DO (%)						57	59.3	56.5	68.1								
26-Jan-23	Sat. DO (%)										98.7	91.1	91.9	91.6		96.8	88.8	
31-Jan-23	Sat. DO (%)		100.9											97.2				
5-Jan-23	DO (mg/L)	>6.0				4.73	4.66	4.31	3.84	4.66								
9-Jan-23	DO (mg/L)	>6.0	9.41											9.32				
10-Jan-23	DO (mg/L)	>6.0		7.05	4.82	4.87												

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						Within / Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG 05	NNG 06	NNG 07	NNG 08	NCH 01	NPH 01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
11-Jan-23	DO (mg/L)	>6.0					5.12	5.07	5.06	4.4								
17-Jan-23	DO (mg/L)	>6.0		7.2	3.83	5.7												
18-Jan-23	DO (mg/L)	>6.0					4.53	4.43	3.62	4.77								
24-Jan-23	DO (mg/L)	>6.0		7.14	4.29	4.98												
25-Jan-23	DO (mg/L)	>6.0					4.82	4.96	4.7	5.6								
26-Jan-23	DO (mg/L)	>6.0									8.45	7.92	7.98	7.95		8.3	8.49	
31-Jan-23	DO (mg/L)	>6.0	9.44											9.34				
5-Jan-23	Conductivity (µs/cm)					75	72	71	78	78								
9-Jan-23	Conductivity (µs/cm)		130											36				
10-Jan-23	Conductivity (µs/cm)			81	83	74												
11-Jan-23	Conductivity (µs/cm)						72	72	78	76								
17-Jan-23	Conductivity (µs/cm)			80	82	75												
18-Jan-23	Conductivity (µs/cm)						72	72	79	79								
24-Jan-23	Conductivity (µs/cm)			81	83	74												
25-Jan-23	Conductivity (µs/cm)						73	73	80	77								
26-Jan-23	Conductivity (µs/cm)										77	81	81	80		152	55	
31-Jan-23	Conductivity (µs/cm)		109											36				
5-Jan-23	Temperature (°C)					24.84	24.4	25.41	24.33	25.6								
9-Jan-23	Temperature (°C)		20.45											18.46				
10-Jan-23	Temperature (°C)			24.6	25.02	24.42												
11-Jan-23	Temperature (°C)						24.19	24.27	24.09	24								
17-Jan-23	Temperature (°C)			24.32	24.34	24.25												
18-Jan-23	Temperature (°C)						24.03	24.17	24.39	24.9								
24-Jan-23	Temperature (°C)			24.38	25.26	24.24												
25-Jan-23	Temperature (°C)						23.84	24.41	24.69	25.25								
26-Jan-23	Temperature (°C)										23.16	22.35	22.39	22.52		20.07	17.57	



		River Name	Nam Ngiep											Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup	
		Zone	Location Refer to Construction Sites											Location Refer to Construction Sites				
			Upstream/Main Reservoir					Within / Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream		
		Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG 05	NNG 06	NNG 07	NNG 08	NCH 01	NPH 01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
31-Jan-23	Temperature (°C)		18.52												17.21			
5-Jan-23	Turbidity (NTU)					1.06	1.12	0.9	2.41	1.57								
9-Jan-23	Turbidity (NTU)		5.25												2.79			
10-Jan-23	Turbidity (NTU)			2.07	1.12	0.92												
11-Jan-23	Turbidity (NTU)						1	0.87	1.5	2.33								
17-Jan-23	Turbidity (NTU)			2.78	1	1.01												
18-Jan-23	Turbidity (NTU)						1.19	0.76	1.88	1.96								
24-Jan-23	Turbidity (NTU)			2.92	0.76	0.81												
25-Jan-23	Turbidity (NTU)						1.76	0.81	2.43	1.62								
26-Jan-23	Turbidity (NTU)										1.64	1.62	2.37	4.59			4.55	4.3
31-Jan-23	Turbidity (NTU)		4.05												4.06			
24-Jan-23	TSS (mg/L)			<5		<5												
25-Jan-23	TSS (mg/L)						<5	<5	<5	<5								
26-Jan-23	TSS (mg/L)										<5	<5	<5	<5			<5	<5
31-Jan-23	TSS (mg/L)		<5												<5			
24-Jan-23	BOD <sub>5</sub> (mg/L)	<1.5		<1		<1												
25-Jan-23	BOD <sub>5</sub> (mg/L)	<1.5					<1	<1	<1	<1								
26-Jan-23	BOD <sub>5</sub> (mg/L)	<1.5									<1	<1	<1	<1			<1	<1
26-Jan-23	Faecal coliform (MPN/100 mL)	<1,000									11	17	4	27			170	79
26-Jan-23	Total Coliform (MPN/100 mL)	<5,000									27	170	27	240			920	110
24-Jan-23	Turbidity (NTU)-bottom					2.8												
25-Jan-23	Turbidity (NTU)-bottom						4.12	1.9										
24-Jan-23	TSS (mg/L)-bottom					<5												
25-Jan-23	TSS (mg/L)-bottom						18.44	<5										
24-Jan-23	BOD <sub>5</sub> (mg/L)-bottom					<1												
25-Jan-23	BOD <sub>5</sub> (mg/L)-bottom						11.06	5.3										

**TABLE A-2: RESULTS OF CAMP EFFLUENTS IN JANUARY 2023**

	Site Name	OSOV1 (Owner's Site Office and Village)		OSOV2 (ESD Camp)		Main Powerhouse	
	Station Code	EF01		EF13		EF19	
	Date	16-Jan-23	30-Jan-23	16-Jan-23	30-Jan-23	16-Jan-23	30-Jan-23
Parameters (Unit)	Guideline						
pH	6.0 - 9.0	6.87	6.7	6.6	6.85	7.1	6.89
Sat. DO (%)		43.9	47.1	46.9	91.1	55.4	64.3
DO (mg/L)		3.67	4.08	4.39	8.04	4.38	5.25
Conductivity (µs/cm)		332	354	420	385	1,100	1,102
Temperature (°C)		24.42	22.39	19.67	21.39	26.95	25.49
Turbidity (NTU)		1.4	1.69	8.22	7.42	41.8	43.5
TSS (mg/L)	<50	<5	<5	7.6	9.05	76.3	56.0
BOD <sub>5</sub> (mg/L)	<30	<6	<6	<6	10.65	32.34	31.0
COD (mg/L)	<125	No sampling	No sampling	No sampling	No sampling	No sampling	No sampling
NH <sub>3</sub> -N (mg/L)	<10.0	No sampling	No sampling	No sampling	No sampling	No sampling	No sampling
Total Nitrogen (mg/L)	<10.0	No sampling	No sampling	No sampling	No sampling	No sampling	No sampling
Total Phosphorus (mg/L)	<2	No sampling	No sampling	No sampling	No sampling	No sampling	No sampling
Oil & Grease (mg/L)	<10.0	No sampling	No sampling	No sampling	No sampling	No sampling	No sampling
Total coliform (MPN/100 mL)	<400	540	1,600	210	9,200	140	9,200
Faecal Coliform (MPN/100 mL)	<400	540	540	170	5,400	79	5,400
Residual Chlorine (mg/L)	<1.0			0.20	0.02	0.10	0.04